

5.2.11 *Recreation and Visual Resources*

This section describes the potential environmental effects of the NorthMet Project Proposed Action on recreational facilities and activities that typically take place in the NorthMet Project area, as well as the surrounding Arrowhead region. Recreation in this region is strongly tied to the aesthetic condition of the landscape so this section also describes the effects of anticipated project activities on visual resources in the NorthMet Project area and surrounding land.

Summary

Most of the Mine Site, a part of the Superior National Forest, is currently public land. However, the Mine Site is surrounded by private land that lacks public roads or trails and is therefore not publicly accessible by land. The Transportation and Utility Corridor and Plant Site are privately owned lands and are not open to the public for recreation. Direct effects on recreation in this area from the NorthMet Project Proposed Action would be limited. With the exception of the Skibo Vista Scenic Outlook, views of project activities would be limited by topography and distance. The NorthMet Project could reduce recreational use of nearby lands, including portions of the Superior National Forest, but would not affect recreational patterns and facilities in the Arrowhead region as a whole. The BWCAW and Voyageurs National Park (recreational resources that are discussed in greater detail in Section 5.2.12) are each more than 19 miles from the NorthMet Project Area. An analysis of potential air quality effects demonstrated that there are no expected effects on visibility in these areas when compared to pristine conditions.

5.2.11.1 Methodology and Evaluation Criteria

5.2.11.1.1 Recreation

The primary issues related to recreational facilities and activities on and near the proposed project facilities include the following:

- Direct effects due to construction, operation, and closure of the NorthMet Project Proposed Action resulting in the reduction of the number and/or acreage of recreational facilities (parks, lakes, trails, etc.) potentially available for public use;
- Indirect effects of the NorthMet Project Proposed Action, including reduction in the use of recreational facilities in areas surrounding the proposed project facilities due to noise, dust, and other disturbances; and
- The net effect of local (i.e., the area surrounding the Mine Site and Plant Site) and regional recreation during post closure.

Evaluation of the NorthMet Project Proposed Action against these criteria was based on comparison to the USFS ROS for land that is controlled by USFS. The USFS uses the ROS to inventory recreational settings and characteristics (see Section 4.2.11.1 for further explanation of the ROS).

Effects on the region's overall recreation resources (e.g., lands not necessarily controlled by USFS) are based on qualitative analysis of NorthMet Project Proposed Action activities, as they relate to the region's recreational opportunities (as summarized in Section 4.2.11). Specific considerations include distance (both direct and via road or trail) between the NorthMet Project and various recreation resources, and the likelihood that the NorthMet Project Proposed Action

would change the noise or visual environment, or the character of water, flora, and fauna present in these resources. These evaluations are based on extensive touring of the region and review of available mapping and descriptive material about the region's recreation resources.

5.2.11.1.2 Visual Resources

The primary issues related to visual resources on and near the Mine Site and Plant Site include the following:

- The nature and severity of effects of the NorthMet Project Proposed Action on sensitive viewpoints, including nearby homes, businesses, and vistas;
- Changes to the extent or scale of visible mining disturbances; and
- The ultimate appearance of the NorthMet Project Proposed Action after reclamation is completed versus current and interim stages of active mining.

Evaluation of the NorthMet Project Proposed Action against these criteria was based on comparison to the USFS Scenery Management System classes for land that is or would be controlled by the USFS. The USFS uses the Scenery Management System to identify desired visual conditions, as expressed by SIOs (see Section 4.2.11.1 for further explanation of SIOs).

Effects on the region's overall visual environment (e.g., lands not necessarily controlled by USFS) are based on qualitative analysis of the NorthMet Project's activities (particularly structures, stockpiles, and other visible activities), as they relate to what observers are likely to see in the region. This understanding is based on extensive touring and photo-documentation of views and visual conditions in the region. In addition, GIS, printed maps, and aerial photography were used to identify potential sensitive viewpoints, for which visual simulations of future mine facilities were developed.

5.2.11.2 NorthMet Project Proposed Action

5.2.11.2.1 Recreation

Surface rights to most of the Mine Site are held by the USFS, as part of the Superior National Forest. As described in Section 4.2.11, the ROS classes for the portion of the Mine Site located on federal lands are Semi-Primitive Motorized and Roaded Natural. The setting and characteristics of the portion of the Mine Site located on private lands is similar to the Roaded Natural class. However, there is no officially established public access (e.g., roads or trails) to the Mine Site (see Section 4.2.11.1), and thus limited opportunity for recreational activity. No access (or recreational opportunities) would be allowed during construction, operation, or closure of the NorthMet Project Proposed Action. Accordingly, the NorthMet Project Proposed Action would have no effect on recreation within the Mine Site.

Construction and operation of the NorthMet Project Proposed Action would be entirely contained within the NorthMet Project area (i.e., the Mine Site, Transportation and Utility Corridor, and Plant Site). Thus, the NorthMet Project Proposed Action would not directly affect access to or use of regional recreational facilities such as other portions of the Superior National Forest, nearby parks and other public lands, or the BWCAW.

The public's enjoyment of recreational activities in the region—such as hunting, fishing, boating, hiking, and winter sports—is tied in part to visual resources, as discussed below, and also to a

wide variety of factors evaluated in other sections of Chapter 5.0. Such factors include, but are not limited to, recreation access including roads, trail access, boat access, and parking areas; the availability and quality of fish and other aquatic species; vegetation; wildlife (particularly game species); noise; air quality; water quality; and wetlands. Effects on these resources are presented in the corresponding sections in Chapter 5.0.

The mine facilities such as mine pits, stockpiles, and associated facilities would be set back from most publicly accessible land, including portions of the Superior National Forest south of the Transportation and Utility Corridor. In addition, the lack of designated trails in these portions of the Superior National Forest means that the number of recreational users who would approach the Mine Site would be limited. Nonetheless, the presence of the NorthMet Project Proposed Action would likely make recreational activities in the immediate vicinity of to the Mine Site, Transportation and Utility Corridor, and Plant Site less enjoyable (and therefore less likely) for some observers. In particular, three potential effects of the NorthMet Project Proposed Action could reduce recreational activity: noise, effects on fish populations (related to recreational fishing), and effects on wildlife populations (related to recreational hunting).

The presence of noise could discourage use of the portions of the Superior National Forest closest to the Mine Site and Plant Site (e.g., immediately south of the Transportation and Utility Corridor). Noise levels, including operational noise, ground vibration, and airblast overpressure, that exceed the most stringent category of state noise standards generally would not extend more than 0.9 mile from the Mine Site during the day and 2.3 miles at night (see Figures 5.2.8-1 through 5.2.8-4).

The ROS classes for those portions of the Superior National Forest within 2.3 miles of the Mine Site are Semi-Primitive Motorized and Non-Motorized. NorthMet Project Proposed Action-related noise would affect up to 6,450 acres of the Superior National Forest within this 2.3 mile area. In these areas, project-related noise could limit full realization of the intended ROS classifications. Outside of the 2.3 mile area, NorthMet Project Proposed Action-related noise would not be inconsistent with ROS classes.

NorthMet Project Proposed Action-related noise, air emissions, and water discharges could potentially influence wildlife behavior in portions of the Superior National Forest closest to the Mine Site and Plant Site, as discussed in the wildlife Section 5.2.5. To the degree that game species are disturbed by NorthMet Project Proposed Action-related noise, they could choose to avoid this portion of the Superior National Forest, leading to reduced hunting opportunities in these areas. However, the area affected by noise comprises approximately 0.2 percent of the more than 3 million acres of the Superior National Forest. Species displaced by noise are likely to remain in surrounding areas of the Superior National Forest; overall opportunities for hunting and wildlife viewing on public lands in the region are not expected to change substantially.

Excluding effects related to noise, fisheries, air quality, and other effects described elsewhere in Chapter 5.0, and given the proximity of active and past mining and industrial activity to high-quality recreational activity in the Arrowhead region (such as the BWCAW), there is no evidence that the presence of the NorthMet Project Proposed Action in and of itself would affect the public's ability to hunt, fish, and conduct other recreational activities, or that it would affect the overall recreational experience (apart from specific activities) in the Arrowhead region as a whole.

After closure, PolyMet would retain ownership of the Mine Site and the federal lands, and public access would likely remain restricted.

The Plant Site is located at the former LTVSMC processing plant. It is owned by PolyMet, and it is not open to the public. Entry roads are gated and/or guarded. No recreational activity is permitted at this site, nor would it be permitted during construction, operation, and closure of the NorthMet Project Proposed Action.

5.2.11.2.2 Visual Resources

At the Mine Site, the maximum height of the waste rock stockpiles would range from approximately 1,840 ft amsl (Category 1 Stockpile and Category 4 Stockpile) to 1,770 ft amsl (Category 2/3 Stockpile), or a maximum stockpile elevation of 180 to 240 ft above ground surface (PolyMet 2015a). The Giants Range rises sharply to the north of the Mine Site, blocking views of the mine, stockpiles, and safety lights (used when the stockpiles are active) from receptors to the north and west, including the BWCAW.

The Mine Site would be in operation 24 hours per day; therefore, nighttime safety lighting of the active stockpiles would potentially contribute to a localized “glow” effect that could be visible in the night sky. Light sources at the Mine Site would be similar to light levels at other mining projects across the Iron Range. For example, most of the lighting at the Mine Site would be directed downward, such as at the digging area in the case of the shovels and loaders, at the driving surface in the case of the haul trucks and locomotives, and at the dumping area at the stockpiles and the rail transfer hopper. The area around the blasthole drills would be illuminated so the drill can maneuver around the pattern. PolyMet does not propose any further specific mitigation measures with respect to light effects (PolyMet, Pers. Comm., July 25, 2012).

The upland forest surrounding the Mine Site to the east, south, and west would shield ground-level views of the Mine Site (including mine, stockpiles, and associated facilities) in those areas. These forest stands are a mix of coniferous and deciduous forests upwards of 60 ft in height and would provide year-round screening within several miles of the Mine Site (except, perhaps, from portions of the Superior National Forest that are very close to the southern boundary of the Transportation and Utility Corridor).

Viewers at elevated vistas to the south would have clearer views of the Mine Site. Figure 5.2.11-1 simulates the profile of the maximum extent of stockpiles (the largest visible component of the Mine Site) from the Skibo Vista Overlook on the Superior National Forest Scenic Byway, approximately 12 miles south-southwest of the Mine Site. Given the 180- to 240-ft height of the stockpiles, a portion of these would be visible above the treeline. The stockpiles would not project above Giants Range or alter the silhouette of the skyline.

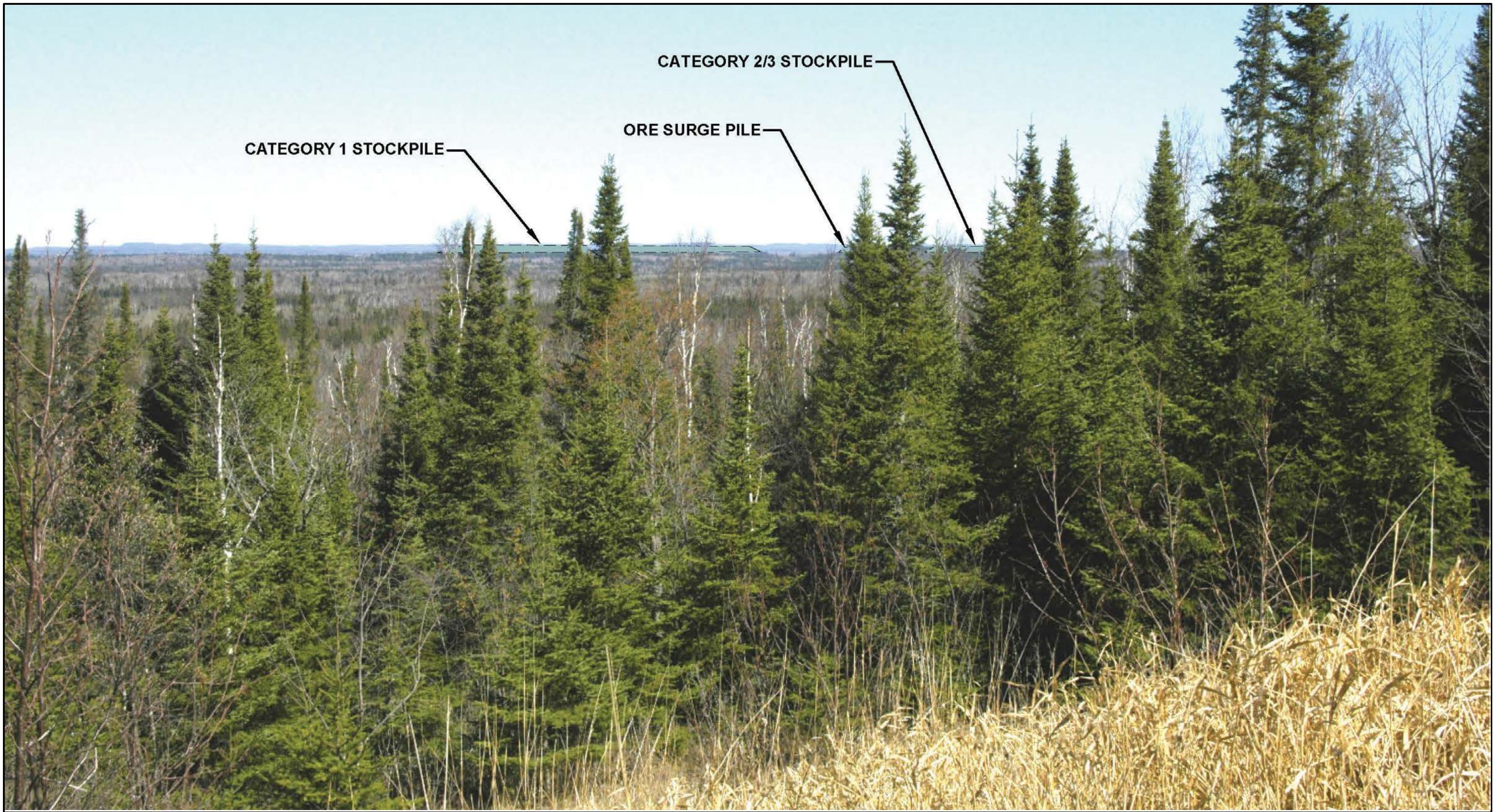


Figure 5.2.11-1
Photo Simulation - View of Mine Site from Skibo Overlook
NorthMet Mining Project and Land Exchange FEIS
Minnesota



-Page Intentionally Left Blank-

Visual conditions would vary throughout the course of the mine's life. Initially, stockpiles would be less visible until heights exceed the surrounding treeline. The Category 2/3 Stockpile and Category 4 Stockpile would reach their maximum heights in year 11, after which they would be relocated into the East Pit. The Category 1 Stockpile would reach its maximum and permanent height in year 12 (excluding the cover material placed over the stockpile at mine closure). The height, shape, and coloring of the stockpiles would vary throughout the life of the mine; however, the coloring of the stockpiles would likely differ from the surrounding landscape, and would likely be more visible during winter months when screening from deciduous trees is at a minimum (although snow cover could tend to make the stockpiles look more like natural landforms). Viewers on elevated terrain to the east, north, or west of the Mine Site would generally have more limited views of the mine and stockpiles, although there could be sporadic direct views of the Mine Site, depending on exact location and vegetative screening.

Mining and associated industrial activities are long-established aspects of the Mesabi Iron Range landscape. The NorthMet Project Proposed Action would introduce visual elements to the landscape that are similar to other active mines in the region, such as the adjacent Northshore Mine. However, these visual disturbances would occur in an area that, as shown in Figure 5.2.11-1, is currently vegetated.

In addition to the new visible components of the Mine Site and Plant Site (see below), mine construction, operations, and closure would likely generate some visible diesel exhaust and fugitive dust emissions from mine vehicles. Construction and closure emissions would likely be difficult to discern from the Skibo Vista Overlook and other distant viewpoints (see Section 5.2.7 for more details on anticipated emissions). As with the mine facilities themselves, construction emissions would generally be difficult to see from closer viewpoints due to the screening effect of terrain and vegetation.

Evaluations of visual conditions are subjective, and are based in part on individual preferences. Many viewers consider any substantial disturbance of the existing landscape to be undesirable, but some viewers find industrial sites visually compelling. While much of northeast Minnesota's recreation and tourist economy is based on high-quality wildlife, wilderness, and vegetation, there are distinct mine-related tourism resources. The Low SIO of the federal lands associated with the Mine Site indicates that the Mine Site is an area where the USFS has determined that evidence of management activities may dominate the view.

Following the completion of the mining activities, the PolyMet reclamation plan would remove all buildings and facilities at the Mine Site, and would revegetate disturbed areas with an approved vegetation mix. The Category 1 Stockpile would remain in place, and would also be vegetated, to the degree possible. This structure would be noticeable above the treeline, especially in winter, as shown in Figure 5.2.11-1. However, other similar stockpiles are found throughout the region. Over time, this feature would take on the appearance of a vegetated hill, and would blend in with the overall landscape.

No substantial changes are anticipated to the visual character of the Plant Site during NorthMet Project Proposed Action operations. The NorthMet Project Proposed Action would use, update, and expand existing infrastructure at the former LTVSMC processing plant, including an expanded Tailings Basin, additional hydrometallurgical processing facilities, and refurbished mill buildings. Figure 5.2.11-2 shows the current view of the Plant Site from Skibo Overlook. New structures constructed as a result of the NorthMet Project Proposed Action would not be

visible from the overlook. During operations, steam plumes from the Plant Site would be visible under certain conditions, particularly from distant viewpoints such as Skibo Vista. To the degree that existing processing buildings are refurbished or removed (as appropriate), the NorthMet Project area would create the appearance of an active, maintained industrial site, rather than the current dilapidated appearance.

The Tailings Basin is visible to rural residences on County Road 358, located approximately 1 mile to the north of the Plant Site. The NorthMet Project Proposed Action would raise the elevation of Cells 1E and 2E to approximately the same elevation as the existing Cell 2W. The hydrometallurgical residue cells would raise the elevation on the southern portion of Cell 2W by about 40 ft. These changes would not be out of character with the existing Tailings Basin, although the low silhouette of the Tailings Basin on the southern horizon would be noticeably expanded.

Through the closure process, all buildings and facilities at the Plant Site would be removed. At-grade (or below-grade) slabs and foundations would remain and would be covered with surface overburden. Most structures would be removed within three years of the start of closure, except for water treatment facilities necessary to maintain post-closure water quality standards. The Plant Site would be revegetated and seeded to promote a self-sustaining community of regionally-appropriate vegetation. As a result, the visual appearance of the Plant Site during and following closure would evolve rapidly from the operations-phase industrial character to a vegetated area that progressively becomes indistinguishable from adjacent vegetated areas.

5.2.11.3 NorthMet Project No Action Alternative

5.2.11.3.1 Recreation

Under the NorthMet Project No Action Alternative, the NorthMet Project Proposed Action would not be developed. The Mine Site would remain unchanged, and the USFS would continue to retain surface rights to the federal lands that comprise portions of the Mine Site. Given other private ownership (e.g., the Transportation and Utility Corridor), the federal lands would remain generally inaccessible to the public. There would be no direct or indirect effects on recreational activities at the Mine Site or the region's surrounding recreational resources. Under the NorthMet Project No Action Alternative, the NorthMet Project Proposed Action would not be developed, and the Plant Site would remain off-limits to the public for recreation or other uses.

5.2.11.3.2 Visual Resources

Under the NorthMet Project No Action Alternative, the NorthMet Project Proposed Action would not be developed, and would retain the Low SIO assigned by USFS. The Mine Site would remain unchanged, and there would be no effects on visual resources at the Mine Site. Under the NorthMet Project No Action Alternative, the NorthMet Project Proposed Action would not be developed. The former LTVSMC process facility would be reclaimed, including building removal, in accordance with a separate closure plan. Reclamation activities could create a short-term disruption of the visual landscape, while long-term effects would be to reduce the developed nature of the site sooner than under the NorthMet Project Proposed Action.

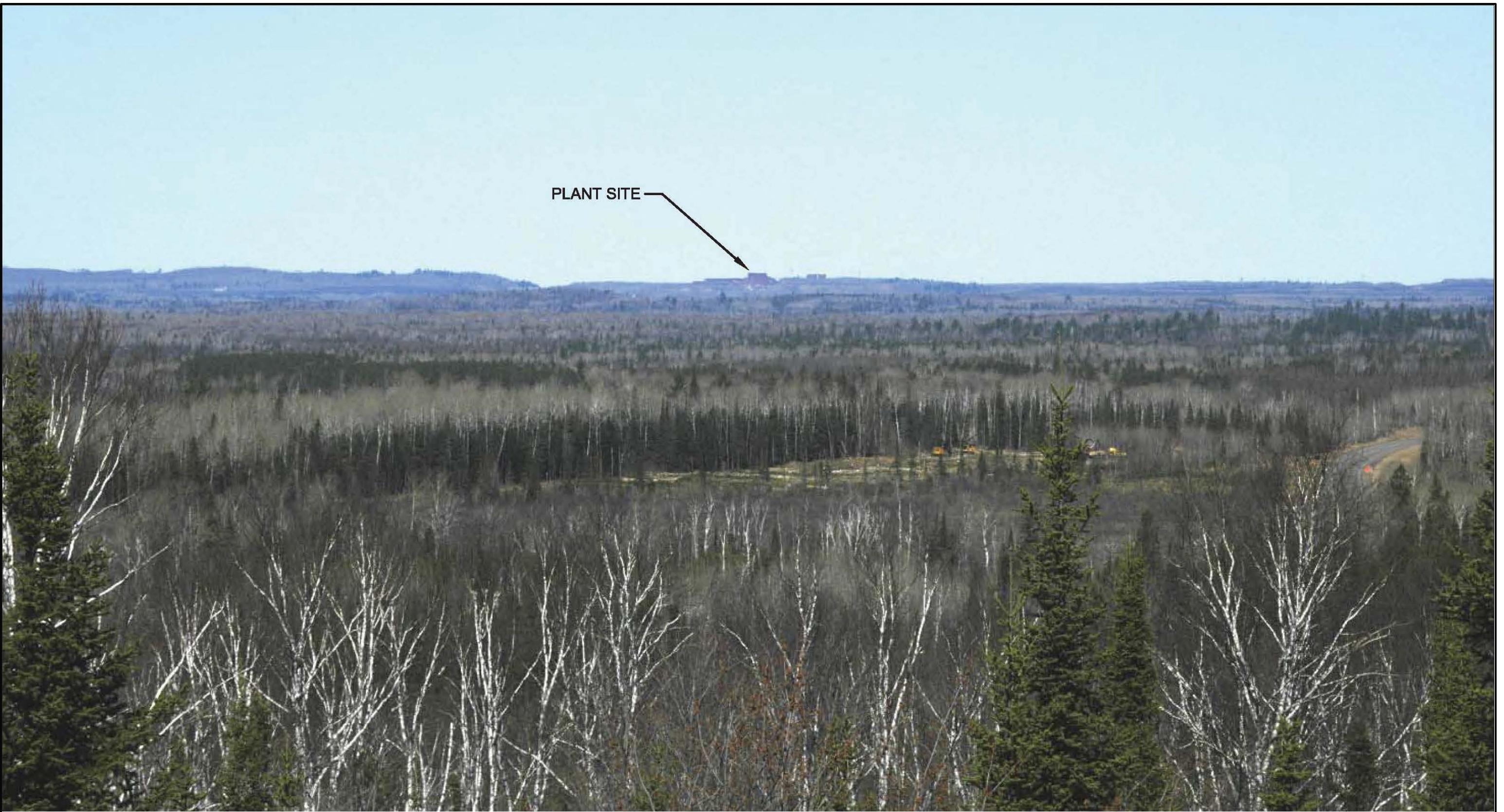


Figure 5.2.11-2
Photo Simulation - View of Plant Site from Skibo Overlook
NorthMet Mining Project and Land Exchange FEIS
Minnesota



-Page Intentionally Left Blank-

5.2.12 *Wilderness and Other Special Designation Areas*

Designations such as Wilderness or RNAs emphasize higher restrictions on human activity and access, while other designations, such as historic landmarks or scenic byways, emphasize management that seeks to enhance public enjoyment of certain spaces. Evaluation of the effects on each type of designation considered how each set of characteristics or management objectives would be changed by the NorthMet Project Proposed Action or the project alternatives. Potential effects could occur due to mining activity or due to changes in other human activity resulting from mining activity. No specific issues related to wilderness or special designation areas were identified during public scoping. As discussed in Section 4.2.12, for the purposes of this analysis, the term “wilderness” is defined by the Wilderness Act of 1964 (Public Law 88-577) (16 USC § 1131-1136). In its planning, management, and monitoring, the USFS identifies four characteristics of wilderness, as defined in the Wilderness Act: Untrammeled, Undeveloped, Natural, and Solitude or a Primitive and Unconfined Type of Recreation.

Summary

The NorthMet Project Proposed Action would have no direct effects on wilderness or special designation areas. Air quality and water quality in these areas would be virtually unchanged from existing conditions; distance from activities associated with the NorthMet Project Proposed Action would leave ambient noise levels also unchanged. The absence of these direct effects means that there would be no indirect effects on wildlife, vegetation, or aquatic species. There could be a minimal visual effect on the Skibo Vista Scenic Overlook along the Superior National Forest Scenic Byway, and therefore an associated indirect effect on recreation.

5.2.12.1 Methodology and Evaluation Criteria

This section uses data presented in Section 4.2.12 for all wilderness or special designation areas (including state parks) within a 25-mile radius of the NorthMet Project area. While no direct effects on wilderness character or special designation areas are anticipated due to changes in air quality, water quality or noise, recreation opportunities could be indirectly affected because of a small change in visual character.

For land that is or would be controlled by the USFS, the recreation evaluation criteria of the ROS system were used to determine indirect project effects (see Section 5.2.11.1.1).

5.2.12.2 NorthMet Project Proposed Action

5.2.12.2.1 Federally Managed Areas

Table 5.2.12-1 lists the federally managed wilderness and other special designation areas within or adjacent to the NorthMet Project area and indicates significant features that would have the most bearing on the potential effects of the NorthMet Project Proposed Action. Isle Royale National Park is outside of the study area for evaluation of Wilderness and Other Special Designation; however, the visibility analyses in Section 5.2.7.2.2 do include Isle Royale National Park.

Table 5.2.12-1 Federally Managed Wilderness and Other Special Designation Areas located within or Adjacent to the NorthMet Project Area

Special Designation Area	Distance (miles) to the NorthMet Project Area	Significant Feature
Boundary Waters Canoe Area Wilderness	25	Laurentian Divide
Voyageurs National Park	50	Laurentian Divide
Research Natural Areas		
Big Lake-Seven Beavers cRNA	12	Watershed, topography, vegetation
Keeley Creek RNA	25	Watershed, topography, vegetation
Dragon Lake cRNA	25	Watershed, topography, vegetation
Unique Biological Areas		
Little Isabella River UBA	25	Watershed, topography, vegetation
Harris Lake National Natural Landmark	20	Watershed, topography, vegetation
National Historic Landmark		
Soudan Iron Mine	18	Topography, vegetation
National Recreation Trail		
Taconite State Trail	15-17	Topography, vegetation

The table shows that all of the federally managed areas would be well-removed from activities related to the NorthMet Project Proposed Action, and generally would be screened by intervening topography and vegetation.

Effects from the NorthMet Project Proposed Action associated with Class I Increment, visibility, and sulfur dioxide effects on flora and fauna would be all well below their respective significance levels in all Class I areas, including the BWCAW and Voyageurs National Park. In addition, all sulfur dioxide and sulfur deposition relating to terrestrial and aquatic settings would be well below “green light” significance levels in these areas. Total nitrogen deposition effects approach their significance levels at the BWCAW (see Section 5.2.7.2.2).

Due to the presence of the Laurentian Divide, there would be no direct effects on waters of the BWCAW or Voyageurs National Park. The NorthMet Project area is in the Lake Superior Basin, while these two Class I areas are to the northeast of the Laurentian Divide where streams and rivers flow to the Hudson Bay Basin.

As described in Section 5.2.8, daytime noise standards for sensitive receptors would not be reached beyond 0.8 mile from the Mine Site and 0.5 mile from the Plant Site. The nighttime noise standards would not be exceeded beyond 2.3 miles from the Mine Site and 1.5 miles from the Plant Site. The BWCAW and Voyageurs National Park, as well as the rest of the specially designated areas within 25 miles of the NorthMet Project area are all located at distances much greater than these ranges and so would not be expected to be directly affected by NorthMet Project Proposed Action-related noise. Nighttime views from the BWCAW toward the NorthMet Project area and nearby towns are such that light from the NorthMet Project Proposed Action would be indistinguishable from other sources of illumination.

The RNAs, cRNAs, and UBAs are also in watersheds not affected by the NorthMet Project Proposed Action so there would be no direct or indirect effects on surface water or groundwater in these areas. Topography and vegetation again screen these areas from view of the NorthMet Project Proposed Action-related activities so there are no direct effects on visual resources or indirect effects on recreation.

By virtue of distance, as well as topography and vegetation, the Taconite State Trail would experience neither direct nor indirect effects from the NorthMet Project Proposed Action.

By virtue of distance, topography, watershed, or vegetation, none of the four characteristics of Wilderness defined above (Untrammeled, Undeveloped, Natural, and Solitude or a Primitive and Unconfined Type of Recreation) would be affected by the NorthMet Project Proposed Action.

5.2.12.2.2 State-Managed Areas

Table 5.2.12-2 shows that all of the state-managed wilderness and other special designation areas would be well-removed from activities related to the NorthMet Project Proposed Action and generally would be screened by intervening topography and vegetation.

Table 5.2.12-2 State-Managed Wilderness and Other Special Designation Areas located within or Adjacent to the NorthMet Project Area

Special Designation Area	Distance (miles) to the NorthMet Project Area	Significant Feature
Boundary Waters Canoe Area Wilderness	25	Laurentian Divide
State Parks		
Soudan Underground Mine State Park	18	Watershed, topography, vegetation
Lake Vermilion State Park	16	Watershed, topography, vegetation
Iron Range Off-Highway State Park	11	Watershed, topography, vegetation
Bear Head Lake State Park	17	Watershed, topography, vegetation
National Historic Landmark		
Soudan Iron Mine	18	Topography, vegetation
National Scenic Byway		
Superior National Forest Scenic Byway	9	Topography, vegetation

All of the state parks have been shown to be in areas where predicted concentrations would be below secondary air standards that are designed to protect public welfare, including decreased visibility and damage to animals, crops, and vegetation. None of the state parks are within watersheds potentially affected by the NorthMet Project Proposed Action, so there would be neither direct effects on water quality nor indirect effects on aquatic species or wetlands.

Topography and vegetation screen the parks from view of the activities within NorthMet Project area, so there would be no direct effects on visual resources and no indirect effects on recreation.

The Superior National Forest Scenic Byway is at a distance where it would be unaffected by NorthMet Project Proposed Action-related noise. Similar to other specially designated resources, there would be no direct or indirect effects due to air quality or water quality (i.e., visibility of waters potentially affected by the NorthMet Project Proposed Action). Most of the Byway is screened from view of the NorthMet Project Proposed Action by topography and vegetation. However, from Skibo Vista Scenic Overlook, which is approximately 12 miles south-southwest of the Mine Site, a portion of the stockpiles would be visible above the treeline. This direct effect would also mean a potentially small indirect effect on recreation.

By virtue of distance, topography, watershed, or vegetation, none of the four characteristics of Wilderness defined above (Untrammeled, Undeveloped, Natural, and Solitude or a Primitive and Unconfined Type of Recreation) would be affected by the NorthMet Project Proposed Action.

5.2.12.3 NorthMet Project No Action Alternative

Under the NorthMet Project No Action Alternative, the NorthMet Project Proposed Action would not be developed. The NorthMet Project No Action Alternative presents no anticipated effect on the BWCAW, Voyageurs National Park, established and candidate RNAs, UBAs, National Historic Landmarks, the Superior National Forest Scenic Byway, and a National Recreation Trail, as the Mine Site and portions of the federal lands would continue to be managed in the same way they have been.

5.2.13 Hazardous Materials

Issues relating to the presence of hazardous materials or waste may include the accidental release of these materials during transportation, storage, handling, and/or use at the NorthMet Project area and any resulting potential effects on the environment. Environmental resources that could potentially be affected by hazardous materials and hazardous waste if they are accidentally released include: air, water, soil, and ecological resources. The APE therefore corresponds to the areas defined for each specific resource.

The NorthMet Project Proposed Action would use, or generate as waste, the following hazardous materials (Barr 2007d; PolyMet, Pers. Comm., November 17, 2011; PolyMet, Pers. Comm., May 11, 2012):

- Fuels, equipment maintenance products, and solvents – diesel fuel, gasoline, oils, grease, lubricants, anti-freeze, solvents, and lead-acid batteries used for equipment operation and maintenance;
- Plant reagents – sodium hydrosulfide, sodium hydroxide, acids, flocculants, and antiscalants used in processing plant applications;
- Mine Site WWTF chemicals – calcium hydroxide (hydrated lime), sodium metasilicate, ferric chloride, sodium hydroxide, polymer flocculent, carbon dioxide liquid, citric acid, and sodium hypochlorite;
- Plant Site WWTP chemicals – potassium permanganate, antiscalant, carbon dioxide liquid, and calcium hydroxide (hydrated lime);
- Blasting agents – ANFO, emulsions, emulsion blends (a blend of ANFO and emulsion), blasting caps, initiators and fuses, and other high explosives used in blasting; and
- Other materials – assay chemicals, and other by-products characterized as hazardous waste.

The MPCA has determined that the hydrometallurgical residue is not hazardous by legal definition under RCRA. PolyMet has provided supporting calculations that have determined the hydrometallurgical residue is not lethal per MN01 definition (PolyMet 2015t). Mishandling of hazardous materials or wastes could result in spills, accidental release, or discharge into the environment, which could cause effects on workers, waters of the state, or the general public. Mitigation measures to prevent releases in transportation, storage, and handling or use of these materials are described in several hazardous material management plans necessary to comply with various regulatory requirements for the NorthMet Project Proposed Action. The following sections present the methodology and evaluation criteria used to estimate the risks to the public and environment from the use of hazardous materials and the generation of hazardous waste during the construction, operation, and closure phases of the NorthMet Project Proposed Action. The presentation is broken down into the major activities of transportation, storage, and handling and use.

Summary

Materials defined as hazardous are a routine part of mining and ore processing. Their handling, storage, and disposal are regulated by a number of state and federal laws. Adherence to these would limit the potential for off-site effects on only the transport of large quantities of hazardous

materials. Transport routes have been defined that limit the potential for effects on population centers and sensitive resources. Given overall Project design and operational commitments, there would be no significant adverse effects from the proposed use or generation of hazardous wastes by the NorthMet Project Proposed Action.

5.2.13.1 Evaluation Criteria

Several criteria are generally used in federal and State of Minnesota regulations and statutes to define the effects from an accidental spill, release, or discharge of contaminants or hazardous material or waste to the environment. The basic principle of these criteria is the protection of people and the environment. Based on this principle, the NorthMet Project Proposed Action would have an environmental effect if the following were to occur:

- A spill, release, or discharge of any hazardous material or hazardous waste during transportation that, if not recovered in a timely manner, could cause pollution of waters of the state, or other harm to the environment or to the public;
- A spill, release, or discharge of any hazardous material or hazardous waste during handling or use, which could cause pollution of waters of the state, or other harm to the environment or to the public;
- Hazardous emissions from handling of any hazardous materials or hazardous waste that have the potential to cause harm to the public or the environment; and
- A spill, release, or discharge from on-site storage facilities exceeding the volumes of the primary and secondary containment structures, and which could not be recovered in a timely manner, and thus pollute waters of the state or cause other harm to the environment or to the public.

5.2.13.2 NorthMet Project Proposed Action

Federal and State of Minnesota regulations establish management and reporting requirements for hazardous materials. Based on current design, applicable administrative rules and statutes include the following:

- *Minnesota Statute 115.061 – Duty to Notify and Avoid Water Pollution (Minnesota Statutes, chapter 115, Water Pollution Control; Sanitary Districts);*
- USEPA 40 CFR 302 – Designation, Reportable Quantities, and Notification, Section 6 – Notification Requirements (USEPA 40 CFR 300–399, Superfund; Emergency Planning; Community Right-to-Know Programs);
- USEPA 40 CFR 355 – Emergency Planning and Notification, Subpart C – Emergency Release Notification (USEPA 40 CFR 300–399, Superfund; Emergency Planning; Community Right-to-Know Programs);
- USEPA 40 CFR 355–372 – EPCRA (USEPA 40 CFR 300–399, Superfund; Emergency Planning; Community Right-to-Know Programs);
- USEPA 40 CFR 112 – Oil Pollution Prevention (USEPA 40 CFR 100–149, Water Programs);

- USEPA 40 CFR 68 – Chemical Accident Prevention Provisions (USEPA 40 CFR 70–99, Air Programs II);
- USEPA Clean Air Act, Section 112(b) – Hazardous Air Pollutants (42 USC chapter 85, Air Pollution Prevention and Control);
- OSHA 29 CFR 1910.120 – Hazardous Waste Operations and Emergency Response (OSHA 29 CFR 1900–1910);
- DOT 49 CFR 100–180 – Hazardous Materials Transportation (Hazardous Materials Transportation 49 CFR 100–180, Chapter I, Pipeline and Hazardous Materials Safety Administration, DOT);
- MSHA Rule 30 CFR Part 47 Hazard Communication (Mine Safety Administration 30 CFR 1–199);
- *Minnesota Statutes*, chapters 115 and 115A–115E – Water Pollution Control, through Oil and Hazardous Substance Discharge Preparedness (*Minnesota Statutes*, chapter 115, Water Pollution Control; Sanitary Districts);
- *Minnesota Rules*, chapter 7151 – Aboveground Storage of Liquid Substances (*Minnesota Rules*, MPCA, chapter 7151);
- *Minnesota Rules*, chapters 7045–7048 – Hazardous Waste (*Minnesota Rules*, MPCA, chapter 7045–7048);
- *Minnesota Rules*, chapters 7507 and 7513 – Hazardous Materials (*Minnesota Rules*, MPCA, chapter 7507–7513);
- *Minnesota Rules*, chapter 7035 – Solid Waste (*Minnesota Rules*, MPCA, chapter 7035); and
- *Minnesota Rules*, chapter 6132 – Nonferrous Metallic Mineral Mining (*Minnesota Rules*, Department of Natural Resources, chapter 6132).

A list of the larger quantity hazardous materials transported, stored, handled, recycled, or disposed, and their classifications, that would be associated with the NorthMet Project Proposed Action construction, operation, and closure is provided in Table 5.2.13-1. The estimated delivery frequency, volumes, and annual use of these materials are also listed in Table 5.2.13-1.

The MPCA reviewed hydrometallurgical residue pilot-testing and analysis data provided by PolyMet and has established the following statements (MPCA, Pers. Comm., October 24, 2014):

1. TCLP testing results of pilot test residues in 2005 and 2009 did not meet the thresholds to be regulated as a RCRA hazardous waste.
2. Elimination of the bulk hydrometallurgical mode from the NorthMet Project Proposed Action since the DEIS would not materially affect the chemical composition of residue stored in the Hydrometallurgical Residue Facility, and 2005 and 2009 testing results will be representative of the residue stored in the Hydrometallurgical Residue Facility if the current Project is approved.
3. New residue resulting from future hydrometallurgical pilot-testing and/or Phase 2 of the NorthMet Project Proposed Action should be tested to verify that the residue remains under RCRA hazardous waste thresholds.

Table 5.2.13-1 Hazardous Materials used during Construction, Operation, and Closure Phases of the NorthMet Project Proposed Action

Material	Classifications & Precautions**	Environmental Concern	Storage Capacity	Deliveries (Estimated Frequency)		Annual Use (Est.)
				Means	Approximate Rate	
ANFO	Explosive 1.1D or 1.5D: Irritant to skin and eyes. May cause nausea if ingested and irritation to nose and throat if ingested.	Harmful to aquatic life at low concentrations.	No on-site storage. Vendor provided on a daily basis.	Vendor/truck	883,333 lbs/month	10,600,000 lbs/year
Booster (solid - cord sensitive)	Explosive 1.1D: Eye irritant. Skin irritant. Inhalation of dust may cause irritation, sneezing or coughing.	May cause elevated nitrate levels in water and could affect aquatic animals.	No on-site storage. Vendor provided on a daily basis.	Vendor/truck	1,555/month	18,650/year
Emulsion	Explosive 1.5D: Eye irritant. May be harmful if ingested. Inhalation may cause dizziness, nausea, or intestinal upset.	May cause elevated nitrate levels in water and could affect aquatic animals.	No on-site storage. Vendor provided on a daily basis.	Vendor/truck	387,500 lbs/month	4,650,000 lbs/year
Diesel fuel	Flammable: Continued exposure to vapors can irritate eyes and lungs. Potentially fatal if ingested.	Any spill or release may cause adsorption to sediment and soil and may cause a visible sheen or deposit of a sludge or emulsion if released to surface waters creating a hazard for plants and animals.	<u>Mine:</u> 3 - 12,000 gal or 2 - 20,000 gal <u>Locomotives:</u> 15,000 gal <u>Plant:</u> 12,000 gal	Tanker truck (volume/tanker truck = 5,500-9,000 gal)	74 tanker truck loads/month	<u>Mine:</u> 5,910,000 gal/year <u>Plant:</u> Uncertain, but relatively minor <u>Locomotives:</u> 473,040 gal/year
Grease (385 lbs/55-gallon drum)	Mild skin irritant, ingestion may cause discomfort.	Spill or release may cause adsorption to sediment and soil and may cause a visible sheen or deposit of a sludge or emulsion if released to surface waters creating a hazard for plants and animals.	Existing bulk storage at Area 1 and Area 2 Shops.	55-gal drums	<1 truck/month	<u>Mine:</u> Unknown <u>Plant:</u> Uncertain, but relatively minor <u>Locomotives:</u> 16 lb/year – each locomotive

Material	Classifications & Precautions**	Environmental Concern	Storage Capacity	Deliveries (Estimated Frequency)		Annual Use (Est.)
				Means	Approximate Rate	
Lubricating oil	Minimal health hazards.	Spill or release may cause adsorption to sediment and soil and may cause a visible sheen or deposit of a sludge or emulsion if released to surface waters creating a hazard for plants and animals.	<u>Mine:</u> 2,000 gal <u>Plant:</u> 2 – 7,000 gal 2 – 12,000 gal 1 – 12,338 gal	Tanker truck (typically <3,000 gal/tanker truck)	2 tanker truck loads/month	<u>Mine:</u> 47,000 gal/year <u>Plant:</u> Uncertain, but relatively minor <u>Locomotives:</u> 200 gal/year – each locomotive
Transmission oil	Minimal health hazards.	Spill or release may cause adsorption to sediment and soil and may cause a visible sheen or deposit of a sludge or emulsion if released to surface waters creating a hazard for plants and animals.	<u>Mine:</u> 1,500 gal	Tanker truck (typically <3,000 gal/tanker truck)	< 2 loads/month	<u>Mine:</u> 33,000 gal/year
Hydraulic oil	Minimal health hazards.	Spill or release may cause adsorption to sediment and soil and may cause a visible sheen or deposit of a sludge or emulsion if released to surface waters creating a hazard for plants and animals. Bio-accumulation is unlikely due to the very low water solubility; bio-availability to aquatic organisms is minimal.	<u>Mine:</u> 2,000 gal <u>Plant:</u> 2 - 2,500 gal	Tanker truck (typically <3,000 gal/tanker truck)	< 1 load/month	<u>Mine:</u> 13,000 gal/year <u>Plant:</u> Uncertain, but relatively minor
Coolant (ethylene glycol mix)	Harmful or fatal if swallowed; eye, skin, and respiratory irritant.	Practically non-toxic to aquatic organisms on an acute basis.	<u>Mine:</u> 600 gal <u>Plant:</u> 6,000 gal	55-gal drums and tanker truck (typically <3,000 gal/tanker truck)	1 delivery/month	<u>Mine:</u> 12,000 gal/year <u>Plant:</u> Uncertain, but relatively minor

Material	Classifications & Precautions**	Environmental Concern	Storage Capacity	Deliveries (Estimated Frequency)		Annual Use (Est.)
				Means	Approximate Rate	
Gasoline (light vehicles)	Flammable; harmful or fatal if swallowed; eye, skin, and respiratory irritant.	Spill or release may cause adsorption to sediment and soil and may cause a visible sheen or deposit of a sludge or emulsion if released to surface waters creating a hazard for plants and animals.	Plant: 2 - 6,000 gal	Tanker truck (typically <3,000 gal/tanker truck)	2 deliveries/month	Plant: 500 gal/day or 178,000 gal/year
Degreaser	Skin and eye irritant, potential inhalation hazard.	Spill or release may cause adsorption to sediment and soil and may cause a visible sheen or deposit of a sludge or emulsion if released to surface waters creating a hazard for plants and animals. Should not be released undiluted into the environment.	Plant: 1 - 400 gal 1 - 2,500 gal	55-gal drums and/or tanker truck (typically <3,000 gal/tanker truck)	As needed to keep full; < 1 delivery/month	Uncertain, likely less than 15,000 gal/year
Used oil	Minimal health hazards.	Spill or release may cause adsorption to sediment and soil and may cause a visible sheen or deposit of a sludge or emulsion if released to surface waters creating a hazard for plants and animals.	55-gal drums or storage tank	Not Applicable	Removed from site as needed typically by vendor with bulk tank truck; approximately 2 times/month	Mine: 47,000 gal/year Plant: Uncertain, but relatively minor Locomotives: 200 gal/year – each locomotive
Caustic (NaOH) (assume 10.7 lbs/gal)	Skin and eye irritant, corrosive.	No known environmental effects.	1,100-gal storage tank	Tanker truck (typically <3,000 gal/tanker truck)	1 load/month	64 t/year
Flocculant (MagnaFloc 10)	Inhalation irritant.	No known environmental effects.	1,875-lb bulk bags	Freight truck	1 truck/2 months	16.5 t/year
Flocculant (MagnaFloc 342)	Low overall toxicity.	Toxic to some species of fish if released into waters.	1,875-lb bulk bags of powder	Freight truck	< 1 truck/month	26 t/year

Material	Classifications & Precautions**	Environmental Concern	Storage Capacity	Deliveries (Estimated Frequency)		Annual Use (Est.)
				Means	Approximate Rate	
Flocculant (MagnaFloc 351)	Low overall toxicity.	No known environmental effects.	1,875-lb bulk bags of powder	Freight truck	<1 truck/month	179 t/year
Sulfuric acid (assume 15 lbs/gal)	Skin and eye irritant, corrosive.	Toxic to some species of fish if released into waters.	78,700-gal storage tank with secondary containment	Bulk rail tank car (13,000-gal or 98-t capacity)	2 tank cars/year	138 t/year
Hydrochloric acid (assume 10 lbs/gal)	Skin and eye irritant, corrosive.	If released into the soil, this material is not expected to biodegrade and may leach into groundwater.	59,500-gal storage tank with secondary containment	Bulk rail tank car (13,000-gal or 65-t capacity)	2 tank cars/month	1,485 t/year
Liquid sulfur dioxide	Extremely corrosive to exposed tissues, DOT poison gas, corrosive.	Toxic to some plants and animals if released into waters.	30,000-gal pressurized storage tank with secondary containment	Bulk rail tank car (15-55 t/car)	2 tank cars/month	1,254 t/year
Sodium hydrosulfide (assume 11 lbs/gal)	Extremely corrosive to exposed tissues. Contact with acid releases toxic gas. DOT corrosive.	Toxic to aquatic organisms if released into waters.	52,600-gal storage tank	Tanker truck (volume/tanker truck = 5,500-9,000 gal)	< 1 tanker/month	334 t/year
Potassium amyl xanthate (PAX)	DOT spontaneously combustible. Mild irritant. Heating and moisture produces H ₂ S, a toxic gas.	Toxic to animals in large quantities. Contact with water liberates extremely flammable gases, which can cause rapid burning and release of toxins into the air.	~30,000-gal storage tank	1,650-lb bulk bags, 25 bags/truck load	~5 trucks/month	1,075 t/year
Methyl isobutyl carbinol (assume 6.72 lbs/gal)	Flammable liquid.	This material is readily bio-degradable and practically not bio-accumulable and is slightly adsorptive in soils and sediments. Practically non-toxic to aquatic animals if released into waters.	~10,000-gal storage tank	Tanker truck (volume/tanker truck = 5,500-9,000 gal)	~ 6 trucks/month	1,124 t/year
Limestone	Harmful if swallowed; eye, skin, and respiratory irritant.	Airborne particulates may cause some harm to environment dependent on concentrations.	Bulk - stockpiled on-site	Bulk rail car (70-110 t/rail car)	Up to 100 rail cars/week from April to October	87,341 t/year

Material	Classifications & Precautions**	Environmental Concern	Storage Capacity	Deliveries (Estimated Frequency)		Annual Use (Est.)
				Means	Approximate Rate	
Lime	Eye and skin irritant; harmful if swallowed. Avoid breathing vapor or dust.	Possibly hazardous in the short term. Degradation products are not likely; however, long-term degradation products may arise.	Bulk - lime silo	Freight truck (20 – 25 t/truck)	15 loads/month	5,181 t/year
Magnesium hydroxide	Harmful if swallowed; eye, skin, and respiratory irritant.	Possibly hazardous in the short term. Degradation products are not likely; however, long-term degradation products may arise.	Storage tank	Bulk rail car (65 – 104 t/rail car)	3 tank cars/month	3,674 t/year
Grinding metals (metal alloy grinding rods and balls)	Harmful if swallowed; eye and respiratory irritant, if fine particles.	Airborne particulates may cause some harm to environment dependent on concentrations.	None required	Bulk rail car (100 t/rail car)	13 rail cars/month	15,600 t/year
Flotation activators (copper sulfate)	Harmful if swallowed; eye and respiratory irritant.	Toxic to fish and plants if released into waters.	9,200-gal activator storage tank	Reuse from Oxidation Autoclave	Not applicable	650 t/year
Ferric chloride (35%)	Very hazardous if ingested; corrosive to eyes and skin; respiratory irritant.	Mutagen; harmful to fish and invertebrates; reproductive effects, low potential for bio-accumulation; no information regarding environmental fate or toxicity.	6,000- and 1,000-gal storage tank	Tanker truck (typically <3,000 gal/tanker truck)	1,200 gal/month	14,400 gal/year
Potassium permanganate	Eye and skin irritant; respiratory irritant.	Mutagen; ecological information not available.	Bulk (dry)	Freight truck	1,300 lbs/month	16,000 lbs/year
Liquid carbon dioxide	Gas is an asphyxiant; prolonged skin or eye contact to gas, liquid or solid (crystals) may cause severe frostbite.	No adverse effects; carbon dioxide does not contain Class I or II ozone depleting chemicals.	Bulk (liquefied gas)	Tanker (cylinder) truck	105 t/month	1250 t/year

Notes:

t = short tons; equal to 2,000 lbs.

Notes:

The United Nations hazard classification system for classifying explosive materials and explosive components is recognized internationally and is used universally by the United States Department of Defense, United States Department of Energy (USDOE) contractors, and the DOT. UN numbers however, are different from the hazard class and division designations used by the DOT.

Hazard Classification 1.1D and 1.5D: 1.1 is a Hazard Class division for Class 1 (Explosives) and is defined as a Mass Detonation Hazard. It is expected that if one item in a container or pallet inadvertently detonates, the explosion will sympathetically detonate the surrounding items. The explosion could propagate to all or the majority of the items stored together, causing a mass detonation. There will also be fragments from the item's casing and/or structures in the blast area. Hazard Class division 1.5 is an Explosive substance, very insensitive (with a mass explosion hazard).

The "D" is the Class 1 Compatibility Group defined as the secondary detonating explosive substance or black powder or article containing a secondary detonating explosive substance, in each case without means of initiation and without a propelling charge, or article containing a primary explosive substance and containing two or more effective protective features (UNO 2012).

**Precautions are described as indicated by NIOSH (2007), or those described in chemical-specific Material Safety Data Sheets (MSDSs) (Montana Refining Company 2011), (Dow 2009), (EDS 2009a), (CSCC 2005), (EDS 2009b), (Praxair Technology 2009b), (Flottec 2009), (Martin Marietta Materials 2007), (Western Lime Corporation 2009), (AluChem 2010), (Old Bridge Chemicals 1999), (H-Valley Chemical 2006), (ClearTech Industries 2010), and (Praxair Technology 2009a).

Material, Storage Capacity, Delivery Means, Delivery Approximate Rate, and Annual Use Estimate (PolyMet, Pers. Comm., November 17, 2011; PolyMet, Pers. Comm., May 11, 2012).

5.2.13.2.1 Transportation

All hazardous materials would be transported by commercial carriers in accordance with state and federal hazardous material shipping requirements. Such carriers would be licensed and inspected by the Minnesota DOT. Tanker trucks would possess a Certificate of Compliance issued by the Minnesota Motor Vehicle Division. These permits, licenses, and certificates would be the responsibility of the carrier. Federal regulations (49 CFR) require that all shipments of hazardous materials be properly identified and placarded. Shipping documents must be accessible and include MSDSs that describe the hazardous material, immediate health hazards, fire and explosion risks, immediate precautions, fire-fighting information, procedures for handling leaks or spills, first aid measures, and emergency response telephone numbers.

Hazardous waste would also be transported from the Mine Site and Plant Site for proper disposal. Transportation of these wastes would require compliance with state and federal regulations that include requirements for hazardous waste manifests with the shipments, labeling, and/or use of placards, and emergency information. PolyMet employees would be trained to manage all wastes in accordance with their specific job duties. Transportation of hazardous waste would be conducted by vendors also licensed and trained to manage hazardous waste.

As identified in Table 5.2.13-1, trucks would be used to transport a variety of hazardous materials to the Mine Site and Plant Site. Shipments of hazardous materials would originate from a number of locations. The risk of accidental truck spills was evaluated using two representative hazardous materials, diesel fuel and PAX, due to the relatively large number of deliveries and health risks associated with these materials (Rhyne 1994). Approximately 74 tanker truck loads of diesel fuel and 5 truckloads of PAX would be delivered monthly. These quantities would amount to approximately 17,800 and 1,200 shipments of diesel fuel and PAX, respectively, based on 20 years of estimated mine life.

For this evaluation, materials were assumed to be shipped from Duluth. These materials would be transported approximately 60 miles along State Highway 53 (four-lane divided highway) from Duluth to Eveleth, and then approximately 20 miles along State Highways 37 and 135 (two-lane highways) from Eveleth to the North Gate access road to the site. This route would take the materials through the towns of Duluth, Twig, Independence, Canyon, Cotton, Central Lakes, Eveleth, Gilbert, Biwabik, and Pineville and across the Cloquet, Whiteface, St Louis, and Embarrass rivers and Paleface Creek. These state highways already provide transportation routes for freight that includes hazardous materials and waste. St. Louis County Emergency Services are available for response to incidents associated with hazardous materials due to the current transport of these materials from existing businesses that use hazardous materials or generate hazardous waste within their operations. Emergency response services vary from medical rescue and ambulance services to fire-fighting and local HazMat-trained response teams stationed in various cities or districts along the defined transportation route. The locations of emergency response services are identified in multiple sectors within the county as defined by the St. Louis County Hazard Mitigation Plan prepared by the St. Louis County Emergency Management division of the St Louis County Sheriff's Office (St. Louis County 2013). The County HazMat Response Team is stationed in Duluth.

The effect of an accidental release would depend on the location in relation to population, local activities, the quantity released, environmental factors, and the nature of the released material. The probability of an accidental release of the representative hazardous materials described above during transportation was calculated using the Federal Highway Administration truck accident statistics model (Rhyne 1994) as presented in Table 5.2.13-2. The definition of hazardous materials, per the Minnesota Hazardous Materials and Uniform HazMat Registration Program is, “a substance or material capable of posing unreasonable risk to health, safety, and property when transported in commerce, as determined by the US Secretary of Transportation.” According to these statistics, the average rate of truck accidents for transport along a rural interstate highway, such as State Highway 53, is 0.64 per million miles traveled. For rural two-lane highways, such as State Highways 37 and 135, the average truck accident rate is 2.19 accidents per million miles traveled.

Table 5.2.13-2 Release Probability of Representative Materials Transported during Construction, Operation, and Closure Phases of the NorthMet Project Proposed Action

Material Transported	Rural State/Interstate Highway (four lane)						Rural State Highway (two lane)						Combined Total Estimated Release (Freeway and Rural Two-Lane)
	No. of Truck Deliveries	Haul Distance (Miles)	Accident Rate Per Million Miles Traveled	Calculated Number of Accidents	Probability of Release Given an Accident (%)	Calculated Number of Spills	No. of Truck Deliveries	Haul Distance (Miles)	Accident Rate Per Million Miles Traveled	Calculated Number of Accidents	Probability of Release Given an Accident (%)	Calculated Number of Spills	
Diesel Fuel	17,800.0	60.0	0.64	0.68352	18.8	0.12850	17,800.0	20.0	2.19	0.77964	18.8	0.14657	0.27
PAX	1,200.0	60.0	0.64	0.04608	18.8	0.00866	1,200.0	20.0	2.19	0.05256	18.8	0.00988	0.018

Source: Federal Highway Administration truck accident statistics model (Rhyne 1994).

The probability of a release or spill was based on accident statistics for liquid tankers carrying hazardous materials. The Federal Highway Administration statistics indicate that on average, 18.8 percent of the total accidents involving liquid tankers carrying hazardous materials resulted in a spill or release.

Using the accident and liquid tanker spill statistics, the evaluation indicates that the probability for an accidental release of liquids under truck transport during the life of the NorthMet Project Proposed Action is less than one spill accident for each of the representative materials considered. The release probability indicates there is a 1.8 percent probability of an accident resulting in a release of PAX, and a 27 percent probability of an accident resulting in a release of diesel fuel that could occur over the entire 20-year life of the NorthMet Project Proposed Action. The higher probability of a diesel fuel accident is due to the greater expected number of diesel fuel deliveries to the site.

The odds of a potential release of hazardous materials during a transportation accident would incrementally increase if the other shipments listed in Table 5.2.13-1 were included. An accidental release could range from a minor oil spill at the Mine Site and Plant Site, where cleanup equipment would be readily available, to a severe spill during transport involving a large release of diesel fuel or other hazardous material, where emergency cleanup equipment would not be readily available. Some of the chemicals could have immediate adverse effects on water quality and aquatic resources if a spill were to enter a surface water body. Considering the overall risk of an accident involving a spill, and the anticipated transport routes, the probability of a spill into a waterway would be moderate. An alternative transportation route, shorter by about 17 miles, was evaluated but rejected because of its close proximity to water bodies such as Wild Rice and Island lakes. The transportation route selected for this evaluation is longer, but is farther away from waterbodies, so in the event that an accidental spill or release of materials occurs, it could be managed in a more timely manner to reduce the likelihood of environmental harm. A shorter route could be used, but the probability of effect on a water body would be greater due to the proximity of the waterbodies.

A large-scale release of hazardous liquids delivered to the site by tanker truck (9,000-gallon capacity) or rail car (up to 13,000-gallon capacity)—such as diesel fuel, acid, or other hazardous materials—could have implications for public health and safety. The location of the release would again be the primary factor in determining potential effects. As indicated in Table 5.2.13-2, the probability of a release anywhere along a proposed transportation route was calculated to be low. Review of the Hazmat Intelligence Portal of the U.S. DOT indicates that the likelihood of a bulk rail incident is 40 percent less than that of a highway incident (PHMSA 2012b). The likelihood of a rail incident, when all incidents are included, is 82 percent less than that of a highway incident (PHMSA 2012a).

In addition to location, the potential harm presented by the material released is a factor in determining the effect of a release. A qualitative evaluation of the materials to be shipped indicates that the probability of causing harm is low for most materials. For example, though ANFO is an explosive, it will only detonate under specific conditions, such as when ignited with detonators, heat, or a sudden shock wave in a confined space. Caustic soda is corrosive and can be fatal if ingested or has prolonged contact with the skin; however, in a spill situation, emergency response would be undertaken to prevent or minimize exposure, such as restricting site access and immediate containment and removal. In the event of a release during transport, the commercial transportation company would be responsible for first response and cleanup.

Local and regional law enforcement, fire protection, and emergency planning agencies would also mobilize to secure the site and protect public safety.

In the event of an accident involving the release of hazardous material, 49 CFR requires that the carrier notify local emergency response personnel, the National Response Center (for discharge of reportable quantities of hazardous materials) (Hazardous Materials Transportation 49 CFR 100–180, Chapter I, Pipeline And Hazardous Materials Safety Administration, DOT). Minnesota Statutes require notification of the Minnesota State Duty Officer (Minnesota Statues, chapter 115, Water Pollution Control). PolyMet and its hazardous material handlers and/or DOT-regulated contractors would be required to comply with these and similar regulatory requirements, which also stipulate emergency planning and response actions.

5.2.13.2.2 Storage

The approximate capacities of hazardous material storage tanks that would be at the NorthMet Project area are listed in Table 5.2.13-1. Mobile tanker trucks may be used on site to fuel and maintain haul trucks, mobile equipment, and locomotives. The number of these trucks and their capacities would be based on NorthMet Project Proposed Action specifications. Tanks and vessels would be positioned on approved secondary containment with interior sumps to route spilled products or process solutions to lined collection areas. In addition, hazardous materials would be unloaded on an approved containment surface with sumps to route spills to lined collection areas. Some of the hazardous material storage tanks at the Mine Site would be double-walled for provision of secondary containment. Mine Site hazardous material storage tanks without double-walls and Plant Site hazardous material storage tanks would be designed to have secondary containment sufficient to hold at least 110 percent of the volume of the largest tank in the containment area. Waste materials such as used motor oil, hazardous waste, and spent hazardous materials would be managed by PolyMet employees while on-site, and shipped off-site for recycling or disposal using a DOT-licensed transporter. In addition, fire assay wastes—including cupels, crucibles, and slag—would be managed by PolyMet employees while on site and shipped off site for recycling or disposal at a licensed facility using a DOT-licensed transporter. Certain materials may be stored on-site for a period before shipment. These materials would be stored in compliance with safety storage requirements as dictated by state and federal requirements. The storage period would also comply with Minnesota and federal storage timeline stipulations. All stored wastes would be appropriately labeled and dated for timeline inspection purposes.

5.2.13.2.3 Handling and Use

Over the life of the NorthMet Project Proposed Action, the probability of minor spills of oils and lubricants would be relatively high. Releases could occur during operations because of a poor connection of an oil or hydraulic line, or as the result of equipment failure. Effects of such minor spills could include contamination of surface water and soil; however, spills of this nature would likely be small, localized, and contained.

Some of these spills may be reportable. In Minnesota, spills or discharges of more than 5 gallons of petroleum products or any quantity of chemicals or materials, whether accidental or otherwise, are required by law to be reported to the Minnesota State Duty Officer at the MPCA, by the person with control of the spill, which, if not recovered, may cause pollution of waters of the state. The responsible NorthMet Project Proposed Action person is required to recover as rapidly

and thoroughly as possible such spilled material, and take immediate action as reasonably possible to minimize or abate pollution of waters of the state (*Minnesota Statutes*, section 115.061, Duty to Notify and Avoid Water Pollution).

Emergency release notification requirements under EPCRA (USEPA 40 CFR, chapter 355) exist in addition to the release notification requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (USEPA 40 CFR, chapter 302). If the NorthMet Project Proposed Action had a release of a CERCLA hazardous substance, it would be required to comply with the notification requirements of EPCRA, and the release notification requirements of CERCLA. If the reportable quantity of a substance were released within a 24-hour period at the NorthMet Project area, and the substance was on the list of extremely hazardous substances under EPCRA or the list of CERCLA hazardous substances (USEPA 40 CFR, chapter 302.4), then PolyMet would be subject to reporting requirements described in 40 CFR 355.60, 40 CFR 302, and the Emergency Notification Procedures in Minnesota as required by Title III of the Superfund Amendments and Reauthorization Act (USEPA 40 CFR, chapters 300 to 399).

The requirements for storage of oils and lubricants, including the requirement for spill prevention, control, and countermeasure (SPCC) planning are found in the Oil Pollution Prevention Act (USEPA 40 CFR, chapter 112) and MN § 115E (Minnesota Statutes, chapter 115, Water Pollution Control; Sanitary Districts). Applicable Minnesota Statutes include: Prevention and Response Plans (Section 115E.04), Response Plans for Tank Facilities (Section 115E.045, Subdivision 2), and Responses to Releases (Section 115C.03). A list of hazardous material management and response plans is presented in Table 5.2.13-3.

Table 5.2.13-3 Hazardous Material Management Plans

Plans	Applicable Statute/Regulation	Materials/Applications
SPCC Plan	USEPA 40 CFR chapter 112	Oil/petroleum spills
Toxic Pollution Prevention Plan (TPPP)	Minnesota Statutes, chapter 115D Subdivision 1(a) USEPA 40 CFR 260 - 279	Waste minimization, handling, storage, disposal, recycling of hazardous substances, chemicals, fluids, and other wastes. Transportation of hazardous materials.
	DOT 49 CFR	
Hazard Communications Standards	MSHA Rule 30 CFR Part 47	Evaluation of the hazards of chemicals mines produce or use and the provision of information to miners.
Emergency Response Plan	OSHA 29 CFR 1910.120 USEPA 40 CFR 68	Hazardous material release response guidance.
Spill Prevention/Response Plan	29 CFR 1910.120/CAA Section 112 Minnesota Statutes, chapter 115E (may also be applicable to trucking vendors)	General guidance Minnesota state guideline for responding to spills and releases.
Risk Management Program	USEPA 40 CFR 68	Hazard assessment, accident history, prevention program and training, and emergency response program.

The threshold quantity, as defined in 40 CFR 112, for triggering the requirement for development of a SPCC plan is 1,320 gallons of petroleum products in bulk container storage greater than 55 gallons. Since the NorthMet Project area would have more than 1,320 but less than 1,000,000 gallons of oil storage, an SPCC plan would be required under 40 CFR 112. The primary goal of an SPCC plan is to develop strategies to prevent oil spills from reaching Minnesota and United States waters. An SPCC plan is thus specific to each facility, providing persons responsible for planning emergency response site-specific information such as a description of facilities, storage information, preventative measures, response action, equipment, and contact information. An SPCC plan must also provide information for routine facility inspections.

To reduce the likelihood of incidental spills of petroleum products, a preliminary SPCC plan has been prepared for the NorthMet Project Proposed Action. The plan identifies potential emergencies that may arise during operations or an activity within the NorthMet Project area. The plan establishes a framework to respond effectively to the identified potential emergencies.

The final SPCC plan would include procedures, methods, equipment, and other requirements to prevent discharges of oil from facilities, and to contain such discharges, should they occur. The SPCC plan would also contain a detailed, facility-specific description of how the operations comply with the requirements of the Oil Pollution Prevention regulation (USEPA 40 CFR, Part 112). The SPCC plan would address measures such as secondary containment, facility drainage, dikes and barriers, sump and collection systems, retention ponds, curbing, tank corrosion protection systems, liquid level devices, and emergency shut-off or release alarms. The final SPCC plan must be certified by a Professional Engineer that in their professional judgment the following are true:

- The SPCC plan is adequate for the facility;
- Technical standards have been considered;
- Inspections and tests are adequate for the facility; and
- The SPCC plan has been prepared in accordance with good engineering practices, including consideration of applicable industry practice.

A final SPCC plan is not possible for the NorthMet Project Proposed Action until construction has been completed. However, PolyMet has prepared a preliminary SPCC plan that is compliant with 40 CFR 112 requirements.

The policies and procedures set forth in the SPCC plan, inclusive of PolyMet's Standard Operating Procedure for Storage Tank Management, would be prepared to comply with *Minnesota Rules*, chapter 7151, Aboveground Storage of Liquid Materials.

The preliminary SPCC plan would be finalized and certified by a Professional Engineer, as required, after petroleum storage and handling facilities have been constructed. Based on current planning information, the final SPCC plan would need to address at least the following areas or activities involving petroleum and other oils:

- A truck fueling station;
- Remote fueling activities (i.e., at the equipment operating location);
- ASTs;

- Large-quantity oil-filled equipment;
- Locomotive fueling (at Area 2); and
- A gasoline fueling station (at the main gate).

The fueling station would consist of an enclosed building for fueling, including floor drain sumps and holding tanks for collection of spills. The holding tanks would be cleaned out, as needed, by a contractor with appropriate certification or license, and the waste would be transported to a recycling, treatment, or disposal facility. One fueling station would typically be provided to fuel all mobile equipment with rubber tires (trucks, dumps, front end loaders, dozers, etc.). This equipment also may be fueled in place by remote fuel tankers. Remote fueling typically would be conducted for equipment located within the mine pits and at material stockpiles (e.g., excavators, dozers, and other tracked equipment). Portable spill clean-up kits would be available at the fueling stations and on the fuel tankers. Standard operating procedures, including spill response plans, would be prepared and associated training would be conducted for fueling operations. Equipment would be attended during fueling operations. When possible, remote fueling would not be performed near sensitive areas, where, if a release were to occur, surface water could be affected. At final design stage, an updated or final version of the current SPCC plan would be prepared for the NorthMet Project Proposed Action facilities, to address specific spill response, cleanup, release notifications, etc. For oil-filled equipment, an appropriate containment system would be constructed so that discharge from a primary containment system would not escape the containment system before cleanup occurs. Alternatively, facility procedures and a contingency plan would be established that define inspections and/or a monitoring program to detect equipment requiring service or failure, and/or discharge. ASTs would be located at the truck fueling station where fuel storage would meet secondary containment standards. The tanks would have a containment dike with membrane, or a concrete enclosure to contain leaks or spills. As previously indicated, double-walled ASTs would not require secondary containment.

The SPCC documents, along with manufacturer MSDSs, would be available in all areas where hazardous materials were expected to be used or produced, and at all areas of fuel and lube-oil storage.

5.2.13.2.4 Emergency Planning and Community Right-to-Know

Management of hazardous materials at the NorthMet Project area would be governed by a number of interrelated federal, state, and local regulations, as listed in the first part of this Hazardous Materials Section. The following discusses federal and Minnesota state actions under EPCRA, including its emergency response-planning activities, Hazardous Chemical Inventory Reporting (Tier II) requirements, and Toxics Release Inventory (TRI) reporting requirements. Minnesota's hazardous materials regulations are codified in the *Minnesota Rules*, chapters 7507 and 7513, and in *Minnesota Statutes*, chapter 299K.

As required by EPCRA, Minnesota has established the Minnesota Emergency Response Commission (ERC), an agency within the Minnesota Department of Public Safety, Division of Homeland Security and Emergency Management. The Minnesota ERC coordinates information specific to hazardous materials at facilities around the state so that local emergency officials are able to prepare for emergencies. The Minnesota ERC serves as the repository for the EPCRA hazardous chemical inventory reports (Tier II reports). Along with the listing of hazardous

materials identified on Table 5.2.13-1, PolyMet would prepare and submit Tier II Emergency and Hazardous Chemical Inventory Report Forms for sodium hydroxide, hydrochloric acid, sodium hydroxide, sulfuric acid, and SO₂, and would be subject to reporting additional hazardous materials or chemicals maintained on-site in quantities greater than the Tier II reporting thresholds.

The Minnesota ERC also collects data from facilities reporting under the federal TRI report program mandated by SARA Title III, Section 313. The NorthMet Project Proposed Action would be subject to TRI reporting based on the quantities of sulfuric acid and SO₂ to be maintained at the NorthMet Project area and could include others depending on actual quantities.

Under the federal Pollution Prevention Act of 1990, facilities subject to TRI reporting must also provide information on the pollution prevention and recycling activities associated with the reported toxic chemicals. The NorthMet Project Proposed Action would be subject to Minnesota's Toxic Pollution Prevention Act (Minnesota Statutes, section 115D.07), and PolyMet would have to prepare a TPPP. The TPPP would describe the facility's processes and operations, and set objectives for the handling, storage, and disposal or recycling of hazardous materials and toxic chemicals to eliminate or reduce at the source, the use, generation, or release of toxic pollutants, hazardous substances, materials, and hazardous wastes.

Under the federal CAA Amendments of 1990 Section 112(r), the NorthMet Project Proposed Action would be subject to the Accidental Release Prevention/Risk Management Plan rule, based on the projected use of hydrochloric acid and other flammable and toxic substances (42 USC, chapter 85, Air Pollution Prevention and Control). PolyMet would be required to develop a Risk Management Program that would include:

- Hazard assessment and potential effects of an accidental release, accident history, and evaluation of worst-case and accidental release scenarios;
- Prevention program including safety precautions, maintenance, monitoring, and training measures; and
- Emergency response program detailing emergency health care, training, and procedures for informing the public and response agencies should an accident occur.

The hazardous material management plans include procedures for evacuating personnel, maintaining safety, cleanup, neutralization activities, emergency contacts, internal and external notifications to regulatory authorities, and incident documentation. Proper implementation of the SPCC plan, TPPP, Hazard Communications, Emergency Response Plan, Spill Response Plans, and the Risk Management Program would minimize the incidents and effects associated with potential releases of hazardous materials.

If present, other hazardous or potentially hazardous materials or wastes would be characterized and managed per the hazardous materials management plans described in Table 5.2.13-3 above, and, if applicable, would adhere to the requirements defined in *Minnesota Rules*, chapter 7045, Hazardous Waste.

5.2.13.3 Potential Mitigation Measures

Mitigation of a hazardous material release would follow the principle of prevention, minimization, and treatment. Prevention would be achieved when any hazardous material was avoided, where possible, by replacing it with a substitute material that was not hazardous. To the extent possible, this has been done; where not possible, precautions to be defined in the TPPP would be taken to properly manage hazardous materials or substances, and keep the potential risk of exposure to a minimum. Accidentally released hazardous material would be treated quickly in accordance with the described plans.

In addition, mitigation processes or procedure definitions would be included in the following:

- Hazardous communication materials, through communications and training programs;
- Overfill protection procedures;
- Provision for secondary containment;
- Establishment of leak detection systems;
- Preventative inspection and maintenance procedures; and
- Emergency response plan.

These measures would be designed to ensure that accidental releases were prevented or minimized, and when they did occur, were responded to quickly and properly.

Monitoring activities proposed for prevention of incidental releases, mitigation, or quick removal of the effects, if hazardous materials were released, include the following:

- Regular inspection and testing of storage containers and facilities;
- Inspection of vessels for leaks, drips, or loss content of containers;
- Verification of locks, emergency valves, and other safety devices, protective equipment, and floors;
- Regular checks on the operability of emergency systems;
- Periodic awareness training for employees;
- Maintaining MSDSs at visible locations for easy access at all times; and
- Regular monitoring of surface water and groundwater quality.

Monitoring and inspection would be an integral part of the hazardous material management processes at the NorthMet Project area.

Given current Project design and operational commitments, this analysis did not identify significant adverse effects from proposed hazardous materials use or hazardous waste generation by the NorthMet Project Proposed Action. Therefore, no additional mitigation measures are proposed.

5.2.13.4 NorthMet Project No Action Alternative

The NorthMet Project No Action Alternative has no risk of environmental effect since no hazardous materials would be used, and no hazardous waste would be generated under this alternative.

5.2.14 Geotechnical Stability

The geotechnical stability of the proposed large-scale material storage facilities for the NorthMet Project Proposed Action is addressed in this section. These facilities are the waste rock stockpiles that would be created at the Mine Site; the Tailings Basin, which would be constructed on top of the existing LTVSMC Tailings Basin; and the Hydrometallurgical Residue Facility, which would be constructed at the existing LTVSMC Emergency Basin.

This section provides a summary of the required design criteria and the methodology and results of the iterative modeling and design process, as well as an overview of the proposed monitoring and mitigation plans.

Summary

Preliminary designs of the waste rock stockpiles, Tailings Basin, and Hydrometallurgical Residue Facility have been developed and shown by PolyMet, through an iterative design and modeling process, to meet the minimum Factors of Safety and water quality evaluation criteria (see Section 5.2.2) acceptable to the Co-lead Agencies. The slope stability and liner integrity of these facilities would be monitored throughout operations and long-term closure. This approach would allow for identification of a need to implement adaptive mitigation measures as a contingency to improve performance should the facilities perform differently from their design.

5.2.14.1 Methodology and Evaluation Criteria

The direct environmental consequences of the proposed large-scale waste material storage facilities, including the disturbance footprint and impacts to water, are discussed under the respective environmental factors in Chapter 5.0. This section addresses the slope stability and liner integrity of the proposed facilities.

If incorrectly designed, constructed, and/or managed, or from other unforeseen circumstances, waste material storage facilities have the potential to increase hydrologic and/or water quality effects and may become unstable, potentially leading to slope or dam failure (and/or other environmental impacts to downstream areas).

The large-scale waste material storage facilities proposed for the NorthMet Project Proposed Action would require compliance with MDNR nonferrous mining and dam safety rules, as well as the MPCA NPDES/SDS Permit. The Dam Safety permit requires that design and safety criteria be met to reduce the risk of potential failure.

The design of geotechnical structures is typically developed using an iterative design and modeling approach where the design is amended until modeling results meet the required minimum design criteria, including Factors of Safety and other requirements for permitting. Factor of Safety is used to describe the ratio of resisting forces to driving forces along a potential failure surface, whereby a Factor of Safety of 1.0 represents equilibrium between the estimated resisting shear strength and the applied shearing load along a specific plane of potential movement. Systems are often designed to a Factor of Safety above 1.0 to allow for unexpected loading conditions, unexpected operating conditions, and variations in estimated material properties.

The specific design and minimum required Factor of Safety criteria for the proposed large-scale waste materials storage facilities and the methodology applied to develop the designs of the

proposed facilities in order to meet these criteria are discussed for each facility in the respective sections below. Technical analysis was performed by PolyMet and reviewed by the Co-lead Agencies.

The potential effects of hypothetical failure scenarios have not been assessed in this FEIS, as the risk of failure is mitigated through application of design and safety requirements including adaptive management procedures.

5.2.14.2 NorthMet Project Proposed Action

5.2.14.2.1 Waste Rock Stockpiles

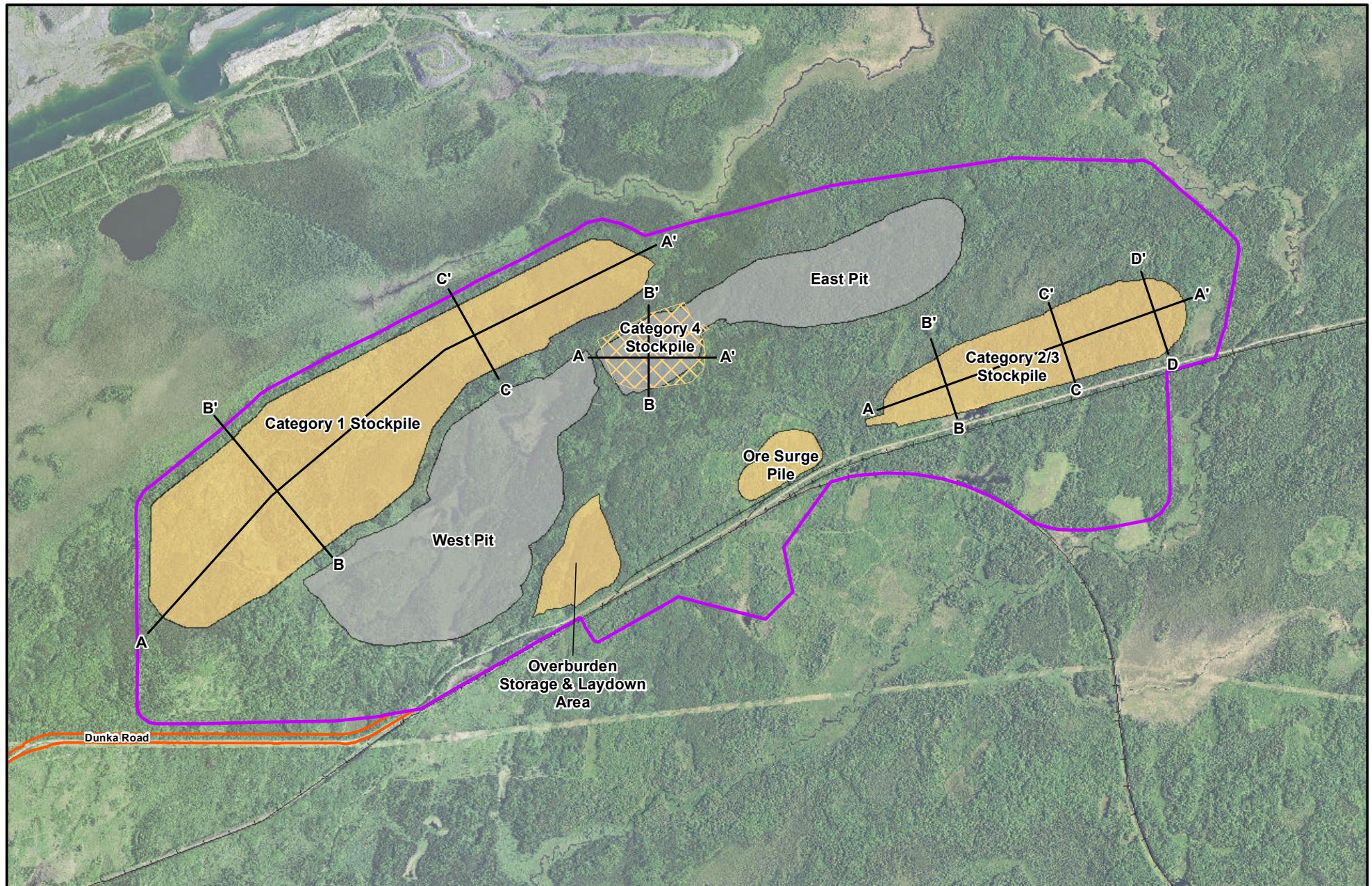
The proposed large scale waste material storage facilities at the Mine Site are:

- A permanent waste rock stockpile for Category 1 waste rock encompassed by a surface water and groundwater containment system and with an engineered geomembrane cover system at closure, and
- Temporary, lined stockpiles for Category 4 waste rock, combined Category 2/3 waste rock, and an Ore Surge Pile.

In addition to the stockpiles above, PolyMet would also prepare an Overburden Storage and Laydown Area that would be used for temporarily stockpiling overburden prior to its use.

PolyMet expects that the NorthMet Project Proposed Action would produce approximately 308 million tons of waste rock over the life of mine. Waste rock would be categorized and managed based on its potential to oxidize. The least reactive, Category 1, waste rock would be placed into a permanent stockpile, while Category 2/3 waste rock and Category 4 waste rock would be stored in temporary stockpiles before being placed as backfill into the East Pit after year 11 of operations. The location of the stockpiles is shown in Figure 5.2.14-1. The total weight of waste rock stored in a permanent stockpile (Category 1 Stockpile) would be approximately 168 million tons (see Section 3.2.2.1.7).

The data inputs, evaluation methodology, results, and design and operating requirements for the stockpiles were reported in Geotechnical Data Package Volume 3 (PolyMet 2014p) and Rock and Overburden Management Plan (PolyMet 2015h) and reviewed by the Co-lead Agencies. Additional geotechnical investigations are required to gain a better understanding of the liner interface frictional values (for the composite liners that would be used at the proposed facility), as well as the geotechnical material properties of the foundation soils in the wetland areas and stockpile geotechnical material properties prior to construction of the stockpiles. PolyMet has committed to undertake further investigations as necessary.



■ Mine Site
■ Active Stockpile
■ Category 4 Stockpile
■ Mine Pit

— Stockpile Cross-Section
— Transportation and Utility Corridor
— Existing Railroad



0 500 1,000 2,000 3,000 Feet



Figure 5.2.14-1
Mine Site Plan - Year 11
 NorthMet Mining Project and Land Exchange FEIS
 Minnesota

November 2015

-Page Intentionally Left Blank-

Design Criteria

Waste rock stockpiles must be designed to comply with *Minnesota Rules*, parts 6132.2200 and 6132.2400 (stockpile slopes are required to meet *Minnesota Rules*, part 6132.2400, subpart 2B and stockpile foundations are required to meet *Minnesota Rules*, part 6132.2400, subpart 2A(1)). These are design requirements that have been established to attain acceptable slope stability Factors of Safety for global stability and acceptable foundation deformations, the latter of which relates to the capability of the composite geomembrane liner system to withstand the strain anticipated due to differential settlement that may occur in the stockpile foundation materials.

The NorthMet Geotechnical Modeling Work Plan (PolyMet 2015l, Attachment A) requires PolyMet to perform stockpile subgrade settlement analysis to predict magnitude of deformation and resulting strain in the stockpile geomembrane liners for comparison to allowable strain in the proposed liner system. Allowable strains are material-specific and would be determined from manufacturers specifications for the materials selected for the stockpile liners.

Methodology

In order to demonstrate that the design of the stockpiles would meet the geotechnical requirements, PolyMet completed the following:

- Collected existing conditions data needed to support foundation design (refer to Section 4.2.14);
- Configured stockpile slopes to meet or exceed the minimum dimensional requirements established by *Minnesota Rules*, part 6132.2400;
- Conducted a stockpile subgrade settlement analysis to predict the magnitude of deformation and resulting strain in the stockpile liners for comparison to allowable strain in the liner system;
- Completed slope stability analyses using RocScience's limit equilibrium program SLIDE; and
- Developed the stockpile design and operating requirements necessary to maintain required slope stability Factors of Safety and liner performance.

Design

The design of the stockpiles would need to conform to *Minnesota Rules*, parts 6132.2200 and 6132.2400. Various design specifications have been established and used for the stockpile analysis (PolyMet 2014p). The following is a summary of the design characteristics applied and considered in geotechnical evaluation.

Preconstruction Design Considerations for Stability and Water Management

Additional geotechnical investigation such as soil borings, test trenches, and geotechnical laboratory tests of on-site materials are required at the locations of the proposed stockpiles to verify the geotechnical information currently available. Examples of information that the additional investigation would yield include: confirmation of the classification of native soils, identification of depths to bedrock and groundwater, identification and delineation of on-site borrow sources, and procurement of additional material samples of waste rock and overburden

soils for laboratory testing. Information would be used to modify stockpile and foundation design and confirm the design assumptions and earthwork balance computations. The additional investigations would take place before stockpile construction but cannot be undertaken until the land exchange has been completed, appropriate permitting has been received, and dewatering of the wetland areas has been performed. As noted above, before construction, the sites would be dewatered and stockpile foundations would be established on soils identified through permitting, that the MDNR agrees to be suitable for structural support; unsuitable soils on the stockpile's perimeter would be removed and replaced with structural fill for stability purposes.

The Category 1 Stockpile would be a permanent, unlined facility. A drainage system would be progressively installed around the stockpile, prior to waste rock placement, to capture ground and surface water flows that may seep from the stockpile.

The temporary Category 2/3 and 4 Stockpiles would include a composite geomembrane liner systems comprised of, from the bottom up, a foundation underdrain system, an impermeable composite liner barrier, and an overliner drainage layer. The composite liner systems are designed to perform on a level commensurate with the level of environmental risk expected by the waste rock classification type. The composite liner system for each temporary stockpile consists of a minimum of one foot of compacted soil overlain by an 80-millimeter thick Linear Low Density Polyethylene (LLDPE) geomembrane liner and a minimum of two ft of granular drainage material. The liners would utilize gravity drainage to a series of collection sumps, and an overliner drainage layer would be constructed to reduce the potential for leaks due to puncturing of the geomembrane by the waste rock. For angular overliner materials, a geomembrane liner load integrity test would be conducted during the additional investigation work mentioned above to support specification of the acceptable geomembrane thickness and polymer type.

Additional information on water containment and management is provided in Section 3.2.2.1.8.

Stockpile Design and Construction

- Stockpile design geometry used for analysis is as follows: minimum width at the top of stockpile: approximately 150 ft or as controlled by the minimum safe turning radius for operating mine haulage trucks
- Perimeter access road for light truck traffic (plus allowance for berms): 20 ft
- Nominal angle of repose slopes: 1.4H:1V (horizontal:vertical) (assumed)
- Maximum slope for stockpile foundation excavation: 2H:1V
- Grading considerations at closure:
 - For the Category 1 Stockpile: 3.75H:1V regraded interbench slopes for the geomembrane cover
 - Regrading is not necessary for Categories 2/3 and 4 stockpiles or the Ore Surge Pile as these are temporary stockpiles
- Height of first lift (over geomembrane, where located): 15 ft
- Height of second lift (over geomembrane, where located): 25 ft
- Nominal lift height (after initial two lifts over geomembrane and where no geomembrane is located): 40 ft

- Maximum stockpile heights and interbench slope configurations considered for stability analyses are:
 - 160 ft at interbench slope angles of 1.4H:1V and 2.5H:1V
 - 200 ft at interbench slope angle of 3H:1V
 - 240 ft at interbench slope angle of 3.7H:1V

Stockpile liner systems and foundation designs used for analysis are as follows:

- Number of development phases: to be determined in permitting
- Minimum grade for foundation underdrains: 0.5 percent
- Minimum grade for drainage collection overliner: 0.5 percent
- Liner system design, including piping and underliner and overliner collection points
- Liner system geomembrane: 80-millimeter linear low density polyethylene (LLDPE)

Cross sections of the proposed stockpiles are shown in Figure 5.2.14-2 and Figure 5.2.14-3.

The stability model (SLIDE) assumed a geomembrane liner interface friction angle (i.e., the strength that the geomembrane possesses for resisting sliding against the adjacent earthen material) of 19 degrees, meeting the criteria of 15.7 degrees or greater. Further geotechnical investigation and laboratory testing is required to verify the liner interface shear strength values as placed against potential borrow materials comprising the underliner material, as well as the shear strength parameters for the foundation and stockpile materials prior to construction. To mitigate associated uncertainty, PolyMet has committed to removing all unsuitable foundation soils from beneath lined stockpiles and replace them (where required) with structural fill to meet strength and grade requirements (PolyMet 2015h). PolyMet has also committed to undertaking further geotechnical investigations prior to the construction of the stockpiles to define the foundation management needs.

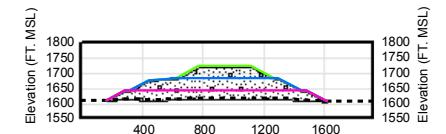
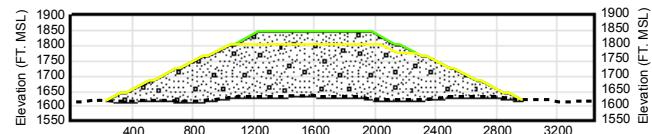
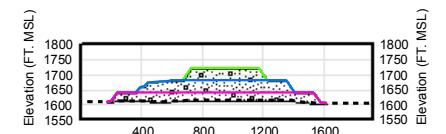
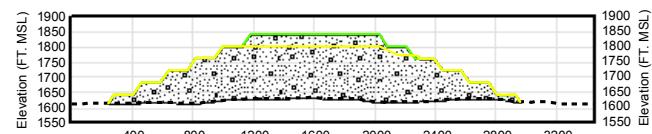
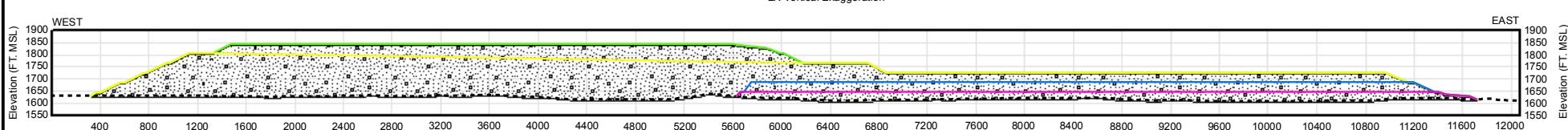
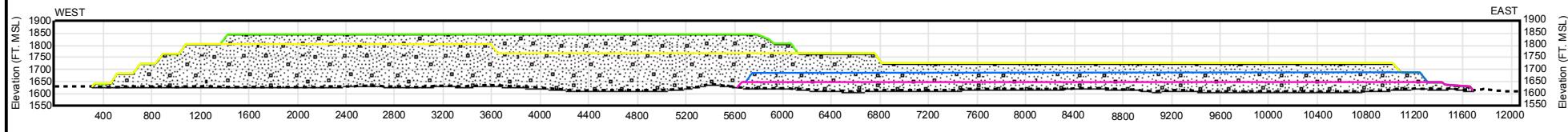
Temporary stockpiles at the Overburden Storage and Laydown Area have not been included in stability analysis given their temporary nature and relatively small size.

Closure of the Stockpiles

The Category 1 Stockpile would be a permanent feature that would be progressively reclaimed, starting in mine year 14, with an engineered geomembrane cover system. Reclaimed configurations are described in the section above and in the stability modeling results below. The cover would include an engineered geomembrane system that would be vegetated to meet the requirements of *Minnesota Rules*, part 6132.2200, subpart 2, item B. A subgrade layer would be placed over the Category 1 Stockpile to provide a uniform layer upon which to construct the cover system. The cover would be designed to promote runoff with reduced erosion potential. To provide an adequate base for sloping of cover materials, Category 1 Stockpile side slopes would be re-shaped to no steeper than a horizontal-to-vertical ratio of 3.75H:1V, with the cover system placed on top of the re-shaped waste rock. The outermost layer would consist of local till soils (also known as “overburden” per *Minnesota Rules*, part 6132.0100, subpart 32) adequate for native vegetation growth. To provide further erosion control, catch benches at least 30 ft in width would remain on the stockpile. Long-term maintenance of the Category 1 Stockpile would

include repairing erosion and removal of woody species and trees from the stockpile cover system to mitigate against the potential for deep root systems puncturing the underlying geomembrane. Additional information on reclamation is provided in Section 3.2.2.1.10 and an overview of monitoring and maintenance actions for stability is provided below.

The Category 2/3 and 4 stockpiles and Ore Surge Pile would be temporary and would be backfilled into the East Pit following year 11. The footprint of the temporary stockpiles would be reclaimed to wetlands or other native habitats where practical.



— Year 1 — Year 2 — Existing Ground Surface
— Year 11

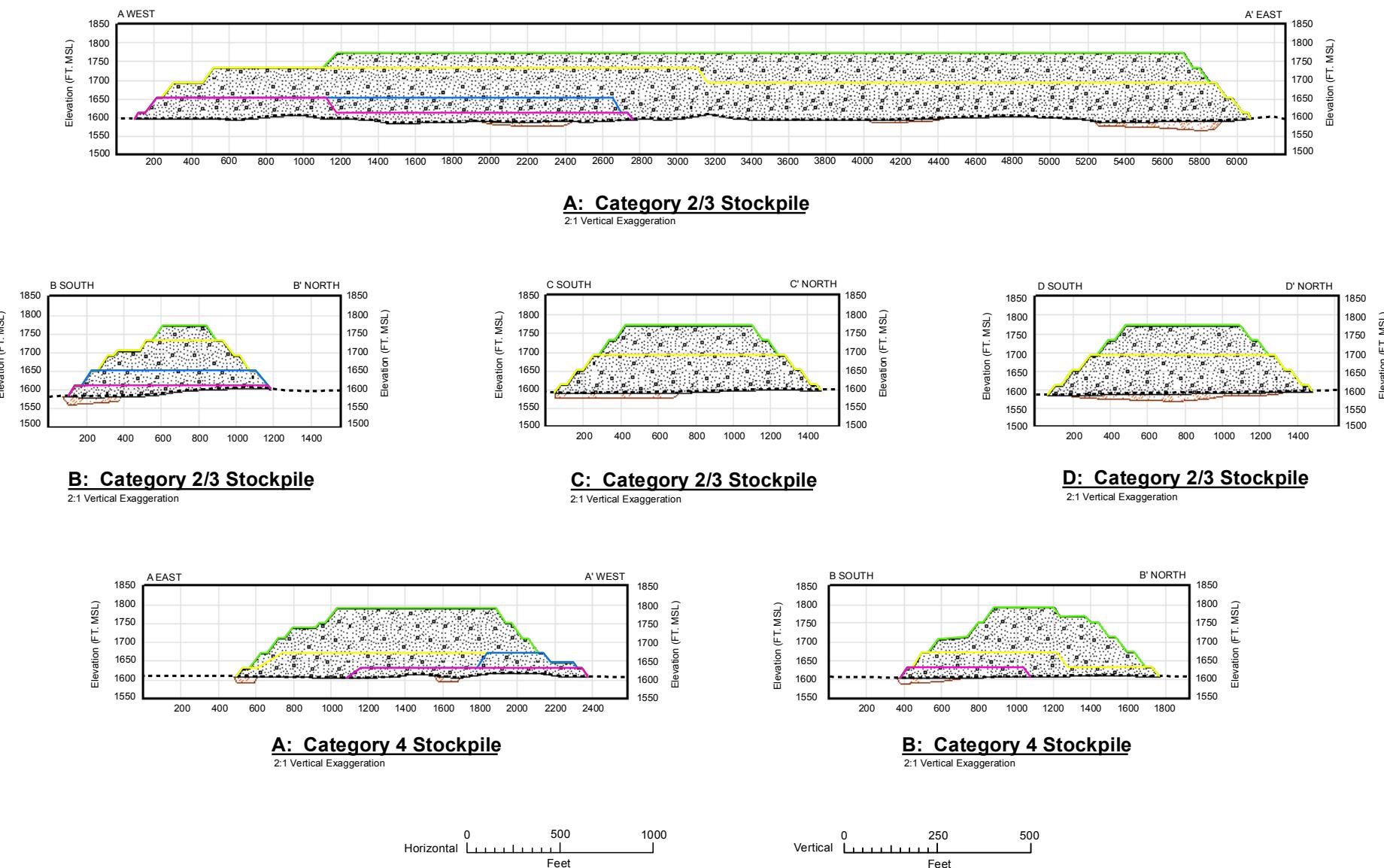


US Army Corps
of Engineers
St. Paul District



Figure 5.2.14-2
Cross Sections of the Proposed Category 1 Stockpile
NorthMet Mining Project and Land Exchange FEIS
Minnesota

-Page Intentionally Left Blank-



— Year 1 — Ultimate Extent
 — Year 2 — Existing Ground Surface
 — Year 11 — Unsuitable Soil Excavation Surface



Figure 5.2.14-3
Cross Sections of the Proposed Category 2/3 and 4 Stockpiles at Maximum Extent
 NorthMet Mining Project and Land Exchange FEIS
 Minnesota

November 2015

-Page Intentionally Left Blank-

Modeling Results

The results reported in Geotechnical Data Package Volume 3 indicate that the proposed design of the stockpiles would meet the required Factors of Safety (PolyMet 2014p). The geotechnical evaluation is summarized below.

Stability

PolyMet undertook a stability analysis of the design cross sections developed to represent the following typical conditions at different phases of stockpile development:

- Temporary Category 2/3 Stockpile, Category 4 Stockpile, and Ore Surge Pile
 1. Initial operational configuration (single lift of waste rock placed in two stages).
 2. Operational configuration at proposed final buildout (excludes the Ore Surge Pile, which would fluctuate).
- Permanent Category 1 Stockpile
 1. Initial operational configuration (a single lift of waste rock with a maximum height of 40 ft placed at the angle of repose).
 2. Operational configuration at proposed final buildout prior to reclamation (assume four lifts of waste rock).
 3. Reclaimed configuration, interbench slopes regraded to 2.5H:1V.
 4. Reclaimed configuration, interbench slopes regraded to 3H:1V.
 5. Reclaimed configuration, interbench slopes regraded to 3.75H:1V.
 6. Assuming a liner interface (i.e., overliner material/LLDPE geomembrane liner/soil liner) friction angle of 19 degrees.

Results indicated that all sections analyzed met the minimum required Factors of Safety.

Estimated liner strains resulting from foundation settlement are less than 1 percent; well below the 30 percent maximum strain allowed in the LLDPE geomembrane proposed for the geomembrane barrier layer component of the basal liner system for the Category 2/3 Stockpile, Category 4 Stockpile, and the Ore Surge Pile.

Proposed Monitoring, Maintenance, and Mitigation

A Construction Quality Assurance Plan would be developed by PolyMet for the stockpile construction prior to permitting. The objective of the plan would be to assure that the construction of the soil and geosynthetic components would be in compliance with the project specifications and to demonstrate that the regulatory requirements for the construction would be achieved. The plan also would provide the means for resolution of problems that may occur during construction. The Construction Quality Assurance Plan would be independent of the quality control programs to be followed by the manufacturers, installers, and the contractor.

A Rock and Overburden Management Plan (PolyMet 2015h) has been prepared by PolyMet that includes a description of the operating plans, monitoring procedures, and adaptive management approaches for the stockpiles.

The stockpile quantities would be monitored throughout the life of the mine and the stockpile heights and footprints would be monitored to verify that they are constructed as designed. Monitoring and maintenance of the Category 1 Stockpile would also continue through the post-closure period until the MDNR determines that the cover is stable. An annual compliance report would be developed each year for submittal to the MDNR to comply with the Permit to Mine requirements.

Information gained through ongoing monitoring would also be used to advise adaptive waste management requirements should the capacity of the Category 2/3 Stockpile, the Category 4 Stockpile, and/or the East Pit be insufficient for the mined volume of Category 2/3 and Category 4 waste rock generated by mining. Adaptive waste rock management could include expansion of the waste rock stockpiles. While moving all of the Category 1 waste rock into the West Pit as backfill was eliminated as a potential alternative (refer to Section 3.2.3.4.2), it may be possible to dispose of some excess waste rock or saturated overburden in the West Pit in areas where mining has ceased, if necessary as an adaptive measure.

Each year, an operating plan and annual report would be completed, as required for the Permit to Mine, to keep the Rock and Overburden Management Plan (PolyMet 2015h) current and to track changes in the mine plan, rock type schedule, and characterization of the material. Modifications to the Rock and Overburden Management Plan based on changes to the material characterization would be completed, as necessary.

5.2.14.2.2 Tailings Basin

Tailings from the beneficiation process would be disposed of in a Tailings Basin, constructed on top of Cell 1E and Cell 2E of the existing LTVSMC Tailings Basin. Figure 5.2.14-4 depicts the Tailings Basin at its proposed final elevation (year 20).

The data inputs, modeling methodology, results, and design and operating requirements for the Tailings Basin were reported in Geotechnical Data Package Volume 1 (PolyMet 2015l) and Flotation Tailings Management Plan (PolyMet 2015n), which were reviewed by the Co-lead Agencies. The information provided in the data package informs the permitting process and is summarized below.

Design Criteria

In Minnesota, dams must be constructed in accordance with applicable requirements of *Minnesota Rules*, parts 6115.0300–6115.0520. In addition, under the NorthMet Geotechnical Modeling Work Plan (PolyMet 2015l, Attachment A), the Co-lead Agencies require that the critical cross section of the Tailings Basin is demonstrated to meet or exceed the following minimum Factors of Safety as required for various loading scenarios:

- Factor of Safety greater than or equal to 1.5 for effective stress conditions using parameters that reflect long-term, drained strength conditions.
- Factor of Safety greater than or equal to 1.3 for short-term, undrained strength conditions for soils that are not prone to static liquefaction using undrained strength conditions.
- Liquefaction analysis of potentially liquefiable materials in undrained strength conditions including:
 - Liquefaction triggering analysis Factor of Safety greater than or equal to 1.1;

- Seismic liquefaction triggering analysis (i.e., induced by design earthquake event) Factor of Safety greater than or equal to 1.2 (or, the Co-lead Agencies may accept a Factor of Safety between 1.2 and 1.0 if the results of deformation modeling are also deemed acceptable by the Co-lead Agencies); and
- Liquefied scenario (assumes all saturated contractive materials have liquefied) Factor of Safety greater than or equal to 1.10.

These minimum Factors of Safety were selected with consideration for:

- The proposed construction of the Tailings Basin on top of the existing LTVSMC Tailings Basin and the known geotechnical conditions and material characteristics of the existing facility;
- The expected characteristics of the NorthMet Project tailings and construction materials and methods, including long-term wet closure; and
- Similar industry standards and other large tailings dams in Minnesota.

-Page Intentionally Left Blank-

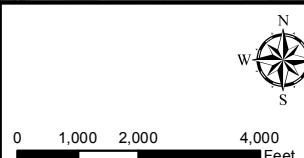
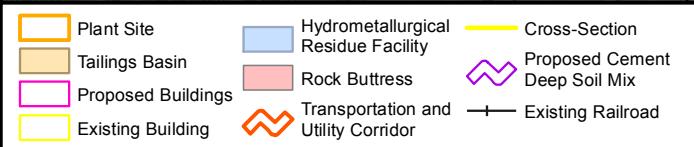
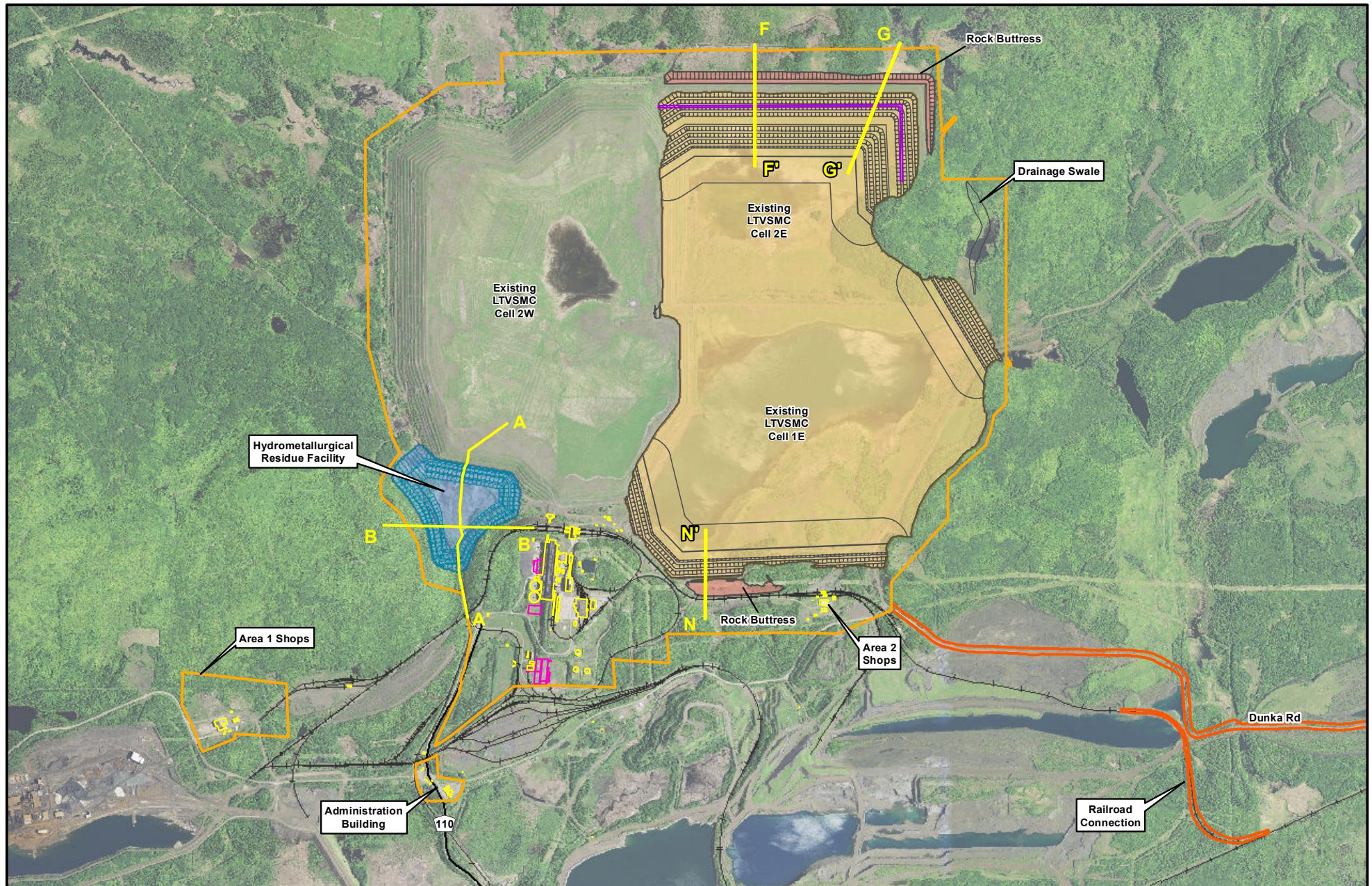


Figure 5.2.14-4
Proposed Plant Site Layout
NorthMet Mining Project and Land Exchange FEIS
Minnesota

November 2015

-Page Intentionally Left Blank-

Methodology

In order to demonstrate that the design of the Tailings Basin would meet the respective geotechnical requirements, PolyMet, in accordance with the NorthMet Geotechnical Modeling Work Plan (PolyMet 2015l, Attachment A) took the following steps:

1. Gathered existing conditions data (i.e., existing basin topography, stratigraphy, soil and tailings strength and hydraulic characteristics [see Section 4.2.14], characteristics of NorthMet tailings based on material produced during the pilot-plant processing, and other data as needed to support geotechnical modeling and Tailings Basin design).
2. Developed Tailings Basin cross sections (i.e., geometry and stratigraphy for existing and planned conditions) for the Tailings Basin for seepage and stability modeling.
3. Developed seepage and stability models using Geo-Slope International, Inc. modeling software (i.e., SLOPE/W, SEEP/W and SIGMA/W as necessary) for various construction and loading scenarios (such as various dam crest and pond surface elevations during construction and closure).
4. Established the geotechnical design data for model input including identification of hydraulic and strength parameters and the triggering potential for static and seismic events of the various tailings material types.
5. Performed modeling and results interpretation.
6. Refined the design and operating requirements necessary until modeling showed that the required slope stability Factors of Safety are achieved for the critical slope cross section.

Design

Various design specifications have been established and used for Tailings Basin geotechnical analysis (PolyMet 2015l). The following is a summary of the design characteristics applied and considered in modeling.

Preconstruction Design Considerations for Stability and Water Management

Before placement of NorthMet tailings, coarse tailings sourced from the existing LTVSMC Tailings Basin would be used to construct a drainage layer to maintain a lowered phreatic surface within the new dam. A lower phreatic surface would help to prevent saturation of the dam embankments. Additional modeling would be conducted to ascertain if this drainage layer needs to be continuous along the length of the dam, or if narrow segments of foundation material would prove to be sufficiently effective.

Rock buttresses would be placed at the northern toe of the existing Cell 2E starter dam, and at the south end of Cell 1E near the railroad fill to provide resistance to the driving forces created by the dam raises. The location of the proposed rock buttress is shown in Figure 5.2.14-4. Peat would be removed from below the rock buttress footprint before placement, so that the rock can be founded on the firmer till and bedrock. Buttress material would likely consist of waste rock sourced from the LTVSMC Area 5 Stockpile (assumed to have the same geochemical properties as Category 1 waste rock for water impact modeling purposes).

Installation of CDSM columns would also be used along the northern and northeastern sides of Cell 2E to enhance the shear strength of the existing LTVSMC fine tailings, slimes, and peat

layers by mixing in situ soil with cement or other suitable stabilizing agent. The location of one proposed CDSM option is shown in plan view on Figure 5.2.14-4, and cross section view on Figures 5.2.14-6 and 5.2.14-7. A potential arrangement of CDSM that may be applied at the Tailings Basin is shown in Figure 5.2.14-5.

As described in Section 3.2.2.3.10, the Tailings Basin design includes a containment system and a storm water management system that would encompass the northern, western and eastern sides of the Tailings Basin. Storm water runoff is not expected to cause significant erosion to the dams. However, if erosion were to occur, more robust erosion control measures would be implemented. A drainage swale would be added to redirect runoff storm waters falling outside of the dams. These design features would not affect the stability of the dams (PolyMet 2015l). Precipitation that falls within the Tailings Basin would be contained by a freeboard that has been designed based on the predicted bounce from a PMP event (PolyMet 2015n). Overflow would be prevented by pumping excess pond water to the WWTP. In the rare event that freeboard within the Tailings Basin, and pumping of excess water to the WWTP, is not sufficient to contain all storm water, water would be directed to an emergency overflow spillway.

A seismic hazard assessment and subsequent liquefaction analysis were undertaken for the Tailings Basin. Results indicated that a significant earthquake is unlikely in Minnesota, and a seismic design event with a peak ground acceleration of 0.024g (2,475 year return period) is not likely to trigger liquefaction in the Tailings Basin materials. Seismic deformation was also considered and the effect of settlement resulting from a design earthquake event would not affect the stability or pond containment of the Tailings Basin.

NorthMet Tailings Basin Design and Construction

The Tailings Basin would be constructed using the upstream method, whereby NorthMet dam embankments would be constructed using preferentially borrowed LTVSMC tailings on top of the existing LTVSMC tailings embankment and on the spigotted tailings adjacent to the perimeter embankment. NorthMet bulk tailings would be discharged into the new basin by perimeter spigots and a pond barge pump. New dam embankments (using LTVSMC Bulk tailings) would be raised in stages on top of the existing LTVSMC tailings impoundment, and the new tailings deposited upstream of the dam into the basin from spigots at the dam's edge. Tailings would also be discharged subaqueously in the basin via a barge.

The Tailings Basin incorporates construction of new dam embankments over the existing LTVSMC Tailings Basin Cells 1E and 2E. The design process is an iterative approach whereby various combinations of stabilization factors including slope angle, lift heights, intermediate slope bench width, drainage layers beneath the proposed NorthMet tailings, CDSM, and supporting rock buttresses were modeled to identify a design that would achieve the following:

- Provide safe permanent storage of tailings generated over the proposed 20-year operating life of the NorthMet Project Proposed Action and maintain stability post-closure;
- Efficiently and effectively recover process water from the surface of the Tailings Basin during operation, and contain groundwater and surface water seepage during operation and over the long term (refer to Section 5.2.2 for more information on water management);
- Accommodate the planned wet cover system at closure; and
- Meet project regulatory requirements (including Factors of Safety).

As shown in Figure 5.2.14-6, Figure 5.2.14-7, and Figure 5.2.14-8 the proposed design consists of eight lifts with a proposed final crest elevation (selected on the basis of tailings storage capacity requirements) modeled as 1,732 ft amsl. This would be an additional 150 ft on top of the existing LTVSMC Tailings Basin Cell 2E. This proposed elevation is similar to the elevation of the existing north dam of Cell 2W, which is at a designed final elevation of 1,735 ft amsl. A schematic cross section of the Tailings Basin is shown in Section 3.2.2.3.5.

The proposed dams would be constructed from mechanically placed and compacted “bulk tailings” taken from the existing LTVSMC Tailings Basin as needed to produce the desired dam lift height and geometry. LTVSMC “bulk tailings” are currently defined as a mixture of tailings from the existing LTVSMC Tailings Basin. The exterior face of the dams would be augmented with a bentonite layer to limit oxygen and rain water infiltration into the Tailings Basin.

The individual lifts would have a slope of 4.5H:1V, which, including setbacks, would provide for an overall slope of approximately 8.6H:1V. Each lift would be 20 ft high, with the exception of the final lift, Lift 8, which would be 10 ft in height. There is a 60-ft bench on top of each lift, with an additional 200-ft setback on top of Lift 4, and a 625-ft beach extending from the interior crest of dam to the edge of the Tailings Basin pond.

Closure of the Tailings Basin

As dams are constructed, exterior slopes would be covered with bentonite and vegetated. Upon reaching the final proposed dam elevation (after 20 years of operation), the Tailings Basin would be closed in accordance with *Minnesota Rules*, part 6132.3200 and would also include the following:

- Bentonite augmentation of the pond area bottom to reduce infiltration to a sufficient degree to maintain desired pond water elevations at closure;
- Slight slope grading of the interior portions for effective storm water routing into the pond area;
- Bentonite augmentation of the exposed embankments and beach areas; and
- Mulching and planting/seeding of native vegetation of upland areas (plants would be selected and monitored to limit root growth from penetrating bentonite).

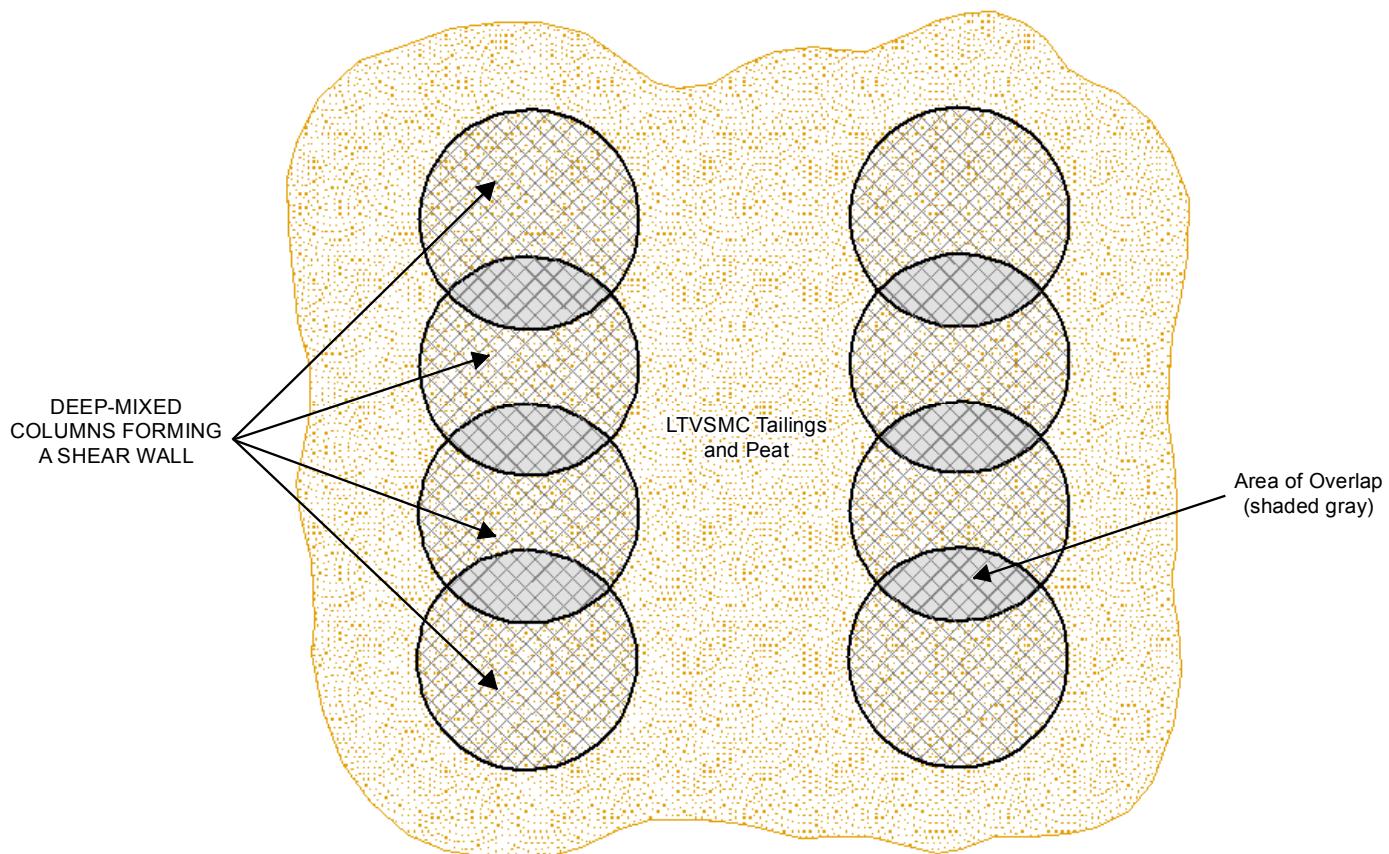
Monitoring and maintenance measures that would be applied post closure are further addressed below and additional details on closure are provided in Section 3.2.2.3.12.

-Page Intentionally Left Blank-

NORTH



Towards Toe of
Tailing Basin



Towards Center
of Tailing Basin



SOUTH

Typical cross-section showing two rows.
Constructed scenario will have several
rows in a vertical alignment.

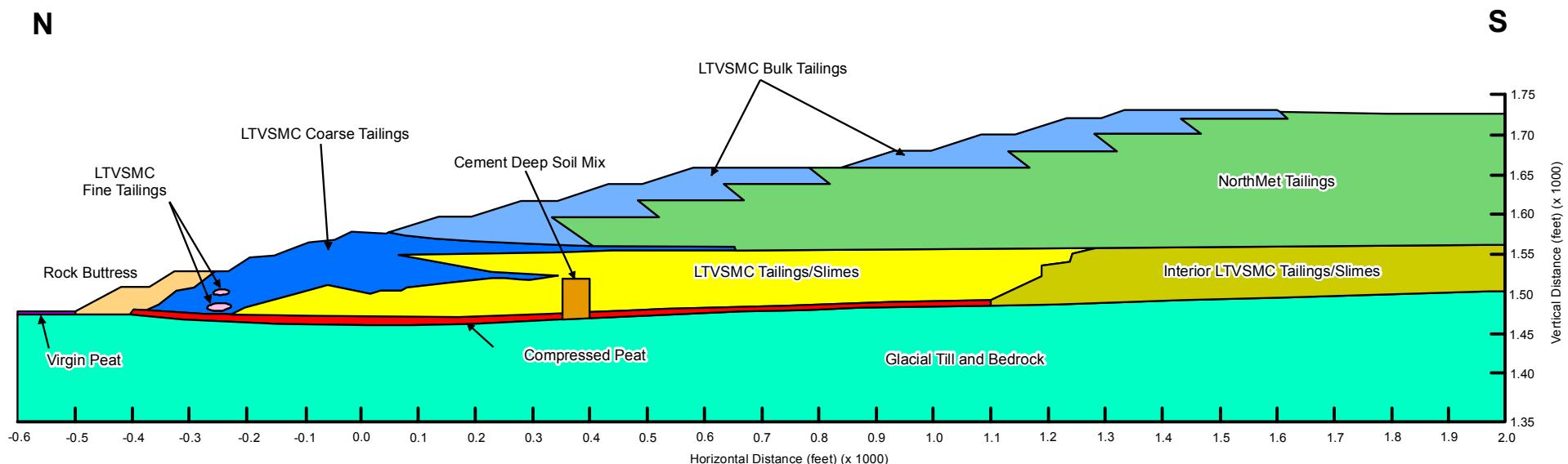
Figure 5.2.14-5
**Potential Cross-section of Cement Deep Soil Mixed
Columns Forming a Shear Wall**
NorthMet Mining Project and Land Exchange FEIS
Minnesota



NOT TO SCALE

November 2015

-Page Intentionally Left Blank-



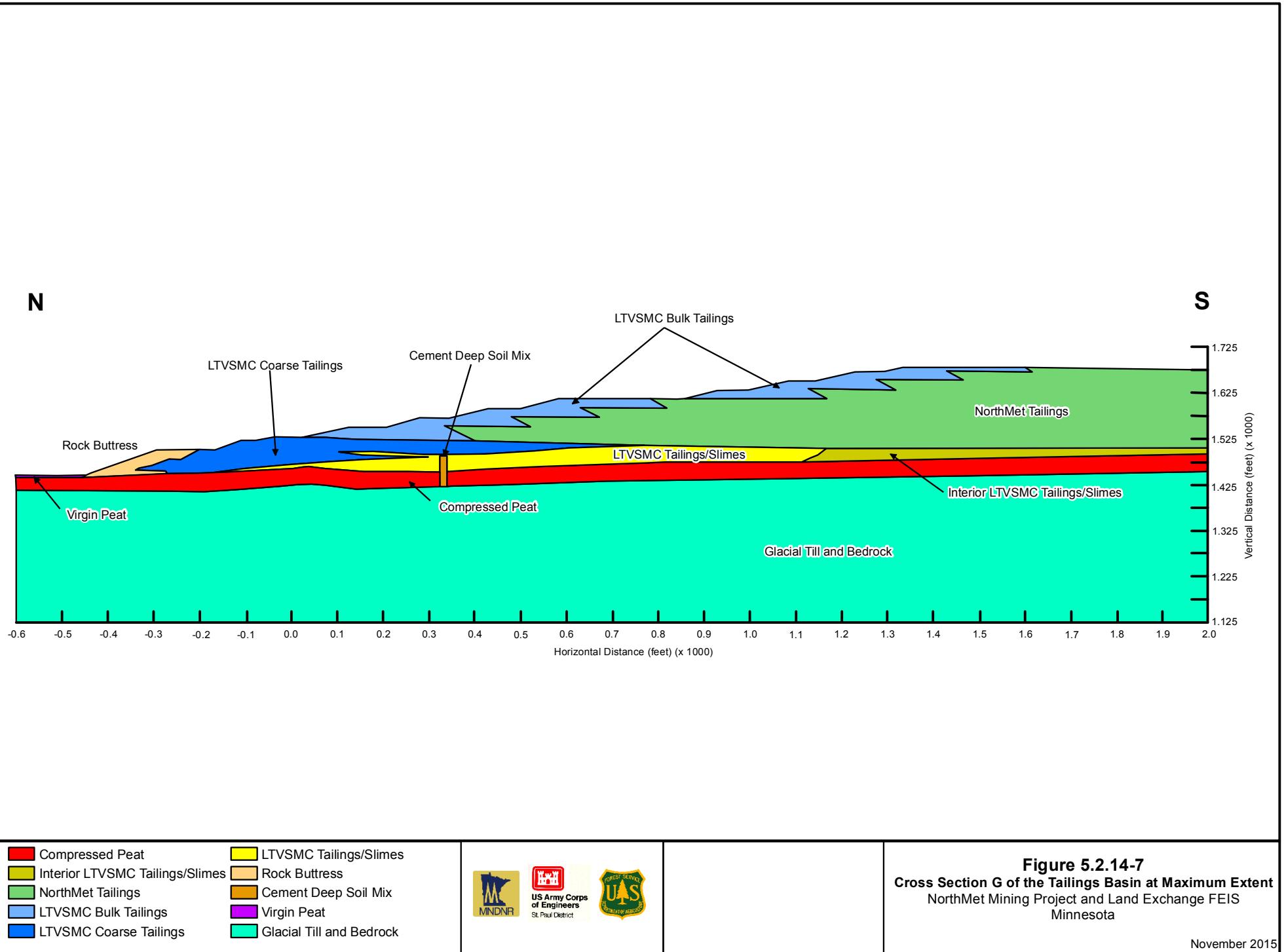
Compressed Peat	LTVSMC Fine Tailings
Interior LTVSMC Tailings/Slimes	Rock Buttress
NorthMet Tailings	Cement Deep Soil Mix
LTVSMC Bulk Tailings	Virgin Peat
LTVSMC Coarse Tailings	Glacial Till and Bedrock
LTVSMC Tailings/Slimes	



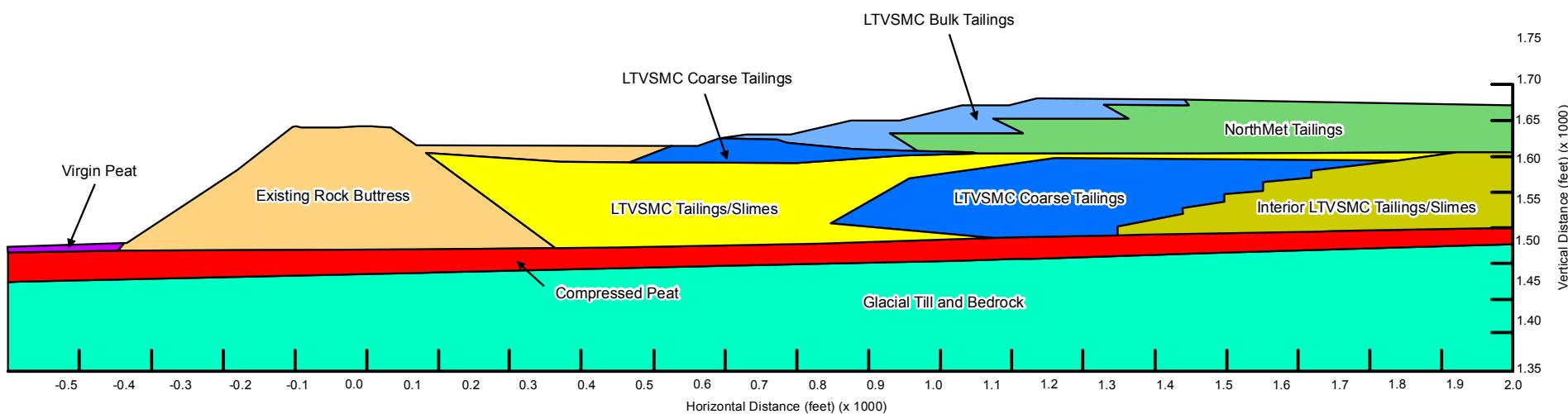
Figure 5.2.14-6
Cross Section F of the Tailings Basin at Maximum Extent
NorthMet Mining Project and Land Exchange FEIS
Minnesota

November 2015

-Page Intentionally Left Blank-



-Page Intentionally Left Blank-

S**N**

Compressed Peat	LTVSMC Tailings/Slimes
Interior LTVSMC Tailings/Slimes	Existing Rock Buttress
NorthMet Tailings	Cement Deep Soil Mix
LTVSMC Bulk Tailings	Virgin Peat
LTVSMC Coarse Tailings	Glacial Till and Bedrock



Figure 5.2.14-8
Cross Section N of the Tailings Basin at Maximum Extent
 NorthMet Mining Project and Land Exchange FEIS
 Minnesota

November 2015

-Page Intentionally Left Blank-

Identification of the Critical Cross Section

Geotechnical conditions along the length of existing LTVSMC Tailings Basin dams have varying layers of coarse tailings, fine tailings, and slimes. Cross Section F, which intersects the northern dam of Cell 2E, as shown in Figure 5.2.14-4, was selected to represent the critical cross section for stability analysis purposes as it is the maximum section based on height as measured from the downstream toe to the proposed final crest, some layers of the weaker fine tailings and slimes extend close to the dam, and the original starter dam is underlain by peat. Material types identified from borings in the existing LTVSMC Tailings Basin along Cross Section F are shown in Figure 4.2.14-3. Figure 5.2.14-6 shows the proposed design of the NorthMet Project Proposed Action Tailings Basin along Cross Section F at its full extent.

Cross Section F was analyzed in a sequential manner consisting of the development of the dam cross section stratigraphy for analyses, application of the material strength and permeability characteristics, and modeling of seepage conditions at the dam cross section, followed by stability analyses.

Cross Section F also was evaluated with the Tailings Basin at the proposed final crest height to determine whether liquefaction would be triggered in the contractive materials, based on certain triggers prescribed in the NorthMet Geotechnical Modeling Work Plan (PolyMet 2015l, Attachment A).

In addition to Cross Section F, Cross Section G and N were selected to represent separate, non-critical sections of the Tailings Basin. These cross sections are shown in plan view on Figure 5.2.14-4. Figures 5.2.14-7 and 5.2.14-8 show the proposed design of the NorthMet Project Proposed Action Tailings Basin along Cross Sections G and N at their full extent respectively. Stability modeling was also performed for these cross sections as described below.

Modeling Results

The results reported in Geotechnical Data Package Volume 1 indicate that the proposed design of the Tailings Basin would meet all respective Factors of Safety as required (PolyMet 2015l). The modeling undertaken and results obtained are summarized below. Subsequent to Geotechnical Data Package Volume 1, PolyMet evaluated the effect that the Tailings Basin groundwater containment system would have on stability. Results indicated that the groundwater containment system would not impact the stability of the Tailings Basin or the Factor of Safety results for Cross Sections F, G, and N determined in Geotechnical Data Package Volume 1 and provided below (PolyMet 2015l). All minimum Factors of Safety correspond to Cross-Section F, confirming that it is the critical cross-section given the analyses performed.

Technical documents have been reviewed by the Co-lead Agencies and these results would be further verified before the completion of permitting.

Slope Stability

The predicted Factor of Safety values for Cross Sections F, G and N at various stages of development of the Tailings Basin are summarized in Table 5.2.14-1. The geometry and physical changes to the embankments (such as CDSM) were incorporated into the design so that all computed slope stability Factors of Safety met or exceeded the Factors of Safety required by the NorthMet Geotechnical Modeling Work Plan (PolyMet 2015l, Attachment A).

Table 5.2.14-1 Summary of Stability Modeling Results

Cross-Section Location	Cross-Section F			Cross- Section G			Cross-Section N		
Case	USSA yield	ESSA	USSA liq	USSA liq	ESSA	USSA liq	USSA yield	ESSA	USSA liq
Target Factor of Safety	1.3	1.5	1.1	1.3	1.5	1.1	1.3	1.5	1.1
Design Scenarios – Steady State Seepage									
Existing Conditions	-	1.83	-	-	2.21	-	-	3.11	-
Interim Lift 2	1.89	3.12	-	2.28	3.43	-	-	-	-
Interim Lift 4	1.74	3.18	-	2.09	3.42	-	-	-	-
Interim Lift 6	1.88	3.18	-	1.93	3.43	-	1.88	4.43	-
Interim Lift 8 – Normal Pool	1.69	3.17	-	1.86	3.44	-	2.00	4.58	-
Interim Lift 8 – PMP Event	1.77	3.18	-	1.85	3.46	-	1.91	4.34	-
Long-Term Stability – Steady State Seepage									
End of Operations	-	3.07	-	-	-	-	-	-	-
20 Years after Closure	-	3.09	-	-	-	-	-	-	-
200 Years after Closure	-	3.21	-	-	-	-	-	-	-
2,000 Years after Closure	-	3.15	-	-	-	-	-	-	-
Cross-Section F Liquefaction Triggering Analysis									
Baseline	2.06	-	-	-	-	-	-	-	-
Plugged Drain	2.06	-	-	-	-	-	-	-	-
Lift 1 Rapid Loading	-	-	1.78	-	-	-	-	-	-
Erosion	1.99	-	-	-	-	-	-	-	-
Plugged Drain	1.91	-	-	-	-	-	-	-	-
Fully Liquefied with Unknown Trigger									
Operations	-	-	1.10	-	-	1.25	-	-	1.16
20 Years after Closure	-	-	1.35	-	-	-	-	-	-
200 Years after Closure	-	-	1.45	-	-	-	-	-	-
2,000 Years after Closure	-	-	1.53	-	-	-	-	-	-

Source: PolyMet 2015l

Notes:

USSA = Undrained Strength Stability Analysis

ESSA = Effective Strength Stability Analysis

Liq = Liquefied conditions

Yield = point of elastic deformation

Liquefaction

The potential for liquefaction, where a triggering event changes the stress state of the material such that it loses a significant amount of its strength, was assessed under different scenarios, including rapid loading and construction, ineffective underdrain resulting in increased saturation, and erosion events. Results shown in Table 5.2.14-1 indicate that the design under these conditions meets the minimum Factor of Safety for Cross Sections F, G, and N.

A scenario for potential liquefaction was evaluated whereby all contractive, saturated soils were modeled with their liquefied shear strengths. Table 5.2.14-1 shows that if the contractive, saturated soils were to liquefy at the end of operations, or 20, 200, or 2,000 years after operations, the design would meet the minimum Factors of Safety deemed acceptable by the Co-lead Agencies.

Potential for seismic activity was also analyzed and assessed. Results indicated that there is a very low likelihood of liquefaction as a result of seismic events.

Long-Term Closure Stability Conditions

While it is normally preferable from a stability perspective to allow tailings facilities to drain following closure, the NorthMet Project Proposed Action involves maintaining a pond on top of the Tailings Basin for water quality management purposes.

The Tailings Basin would be covered with a bentonite-amended surface on the exterior face of the NorthMet Project dam lifts (amended during construction). After the Tailings Basin has been filled to its maximum height, the dam would be prepared for reclamation by amending the 625-ft beach of tailings and the bottom of the pond with bentonite. A closure overflow channel would be constructed to drain excess water from the Tailings Basin pond in order to maintain appropriate freeboard and beach lengths.

Modeling was undertaken to predict the long-term stability of the Tailings Basin. As shown in Table 5.2.14-1, the long-term closure slope stability Factors of Safety are above the minimum value required under the Work Plan.

Proposed Monitoring

Geotechnical investigations would be performed on the Tailings Basin during construction and operations to confirm that the construction and performance of the dam meet design criteria. Results may inform adaptive design changes to ensure stability criteria would be met as construction progresses. This approach is typical for large earthen structures that are developed incrementally over long periods of time.

A Flotation Tailings Management Plan (PolyMet 2015n) has been prepared by PolyMet that includes a description of the operating plans, monitoring procedures, and adaptive management approaches for the Tailings Basin. Monitoring activities include construction material sampling, geotechnical instrumentation, geotechnical investigations, and systematic dam safety inspections.

Existing and proposed geotechnical instrumentation would measure actual tailings dam performance by monitoring stability, seepage, and deformation. Monitoring instrumentation relevant to geotechnical stability would include:

- **Piezometers** to facilitate monitoring of the pore water pressure within the Tailings Basin and perimeter dams (the phreatic surface has a significant effect on slope stability), which would be compared to modeled phreatic surface.
- **Inclinometers** to facilitate monitoring of the movement of the Tailings Basin dams.
- **Survey monitoring points** to facilitate the monitoring of horizontal and vertical deformation (including settlement) of the Tailings Basin dams.

Geotechnical investigations and systematic dam safety inspections would include:

- Staff observation of the condition of the dam and the reporting of any conditions that indicate a departure from the design specifications.
- Weekly/daily routine dam inspections by staff to observe the conditions and performance of the Tailings Basin dams and associated facilities so that any changes to dam conditions could be identified and promptly addressed. These would supplement more detailed Dam Safety Inspections (below).

- Regulator Dam Safety Inspections to evaluate, on a regular basis, the current and past performance of the Tailings Basin dams and to observe potential deficiencies in their condition, performance, and/or operation.
- Semi-annual Dam Safety Inspections undertaken by an independent Minnesota-registered consulting engineer retained specifically for dam safety expertise.
- Inspection after unusual events to monitor and report observations.
- Routine Dam Safety Reviews every 5 years by a qualified geotechnical engineer registered in the State of Minnesota. The review would ascertain that the dam has an adequate margin of safety, based on the current Dam Safety Permit, current engineering practice, and updated operations and design input data. A Dam Safety Review may also be carried out to address a specific problem.

Annual reports on the conditions of the Tailings Basin are required under the MDNR Dam Safety Permit and Permit to Mine. Monitoring and maintenance would continue post closure in accordance with permit requirements.

Proposed Maintenance and Mitigation

Typical maintenance of the facility would include repairing eroded surfaces and repair and/or replacement of damaged monitoring and operational infrastructure. The majority of the non-mechanical maintenance work at the Tailings Basin would be carried out on an as-required basis, rather than on a scheduled basis because it is driven by weather events rather than hours of operation.

Where monitoring or model updates indicate that the Factor of Safety for the Tailings Basin may no longer meet design criteria, appropriate modifications to the Tailings Basin would be considered, modeled, and, if necessary, undertaken. Modifications could include but are not limited to: modification of bench widths between lifts of the dam, modification of lift heights, and modification of slope angles. Other modifications could include increasing the size of the rock buttress, improving the performance of underdrains, and increasing mid-slope setbacks.

A Contingency Action Plan has been prepared as part of the Flotation Tailings Management Plan (PolyMet 2015n). The plan provides guidance to on-site personnel and emergency responders in the case of unplanned occurrences at the Tailings Basin. The plan defines three levels of hazardous and emergency conditions response:

1. Level 1 is defined as unusual conditions that do not warrant an emergency response but require prompt investigation and resolution.
2. Level 2 is defined as conditions that represent a potential emergency, if sustained or allowed to progress, but no emergency situation is imminent. The first action in the event of a Level 2 emergency condition is to discuss and define a response plan.
3. Level 3 is defined by either imminent failure of the Tailings Basin or a significant component thereof. The first actions in the event of any Level 3 condition are to check all persons who could potentially be affected are safe, initiate the appropriate chain of communications, and immediately undertake appropriate response actions.

Long-term maintenance tasks at the Tailings Basin would include:

- Annual inspection of vegetation on the exterior dam faces and interior beaches, with erosion repaired and vegetation reseeded in accordance with requirements of plans as needed until released from these activities by the MDNR;
- Snow removal from the dam crest to allow access during winter months;
- Reconstruction of eroded dam crest, slope or toe;
- Mulching for fugitive dust control in accordance with requirements of plans; and
- Repair and/or replacement of damaged instrumentation and monitoring.

5.2.14.2.3 Hydrometallurgical Residue Facility

As shown in Figure 5.2.14-4, hydrometallurgical residue would be disposed of in a new Hydrometallurgical Residue Facility that would be located at the site of the existing LTVSMC Emergency Basin, adjacent to the southern extent of existing LTVSMC Tailings Basin Cell 2W.

The data inputs, modeling methodology, results, and design and operating requirements for the Hydrometallurgical Residue Facility were reported in Geotechnical Data Package Volume 2 (PolyMet 2014c) and reviewed by the Co-lead Agencies. The information provided in the data package informs the permitting process and is summarized below.

Design Criteria

The design of the Hydrometallurgical Residue Facility must meet the applicable requirements of *Minnesota Rules*, parts 6115.0300–6115.0520 and the requirements of the NorthMet Geotechnical Modeling Work Plan (PolyMet 2015l, Attachment A), which include the following:

- The ability of the most sensitive slope cross section to meet a global slope stability Factor of Safety of 1.5;
- The ability of the composite liner system to comply with infinite slope stability Factor of Safety of 1.5, and
- The capability of the composite liner system to withstand the longitudinal strain anticipated due to differential settlement that may occur in the facility foundation materials.

Methodology

PolyMet took the steps listed below in order to demonstrate that the design of the Hydrometallurgical Residue Facility would meet the respective geotechnical requirements and would be in accordance with the NorthMet Geotechnical Modeling Work Plan (PolyMet 2015l, Attachment A):

1. Gathered existing conditions data (i.e., facility foundation material stratigraphy and strength data, hydrogeological data, characteristics of NorthMet Project Proposed Action residues based on those produced during the pilot-plant processing, and other data as needed to support geotechnical modeling of the Hydrometallurgical Residue Facility) (see Section 4.2.14).

2. Developed residue facility layout and cross sections (i.e., geometry and stratigraphy for existing and planned conditions) for proposed residue facility stability and deformation modeling.
3. Developed seepage and stability models using Geo-Slope International, Inc. modeling software (i.e., SLOPE/W, SEEP/W and SIGMA/W as necessary) for maximum facility dam height with minimum and maximum pond elevation, and post-closure – cover effective with minimum pond elevation.
4. Established the geotechnical design data for model input including identification of strength parameters and the triggering potential for static and seismic events.
5. Ran the models to determine Factors of Safety, and the potential for slope failure and deformation of the foundation and liner.
6. Refined the design and operating requirements necessary to maintain required slope stability Factors of Safety and deformation requirements for the critical slope cross section.

Design

Various design specifications have been established and used for the Hydrometallurgical Residue Facility geotechnical analysis (PolyMet 2014c). The following is a summary of the design characteristics applied and considered in modeling.

Preconstruction Design Considerations for Stability and Water Management

The proposed Hydrometallurgical Residue Facility would be located on top of the existing LTVSMC Emergency Basin, and would include a double liner and leakage collection system. To prevent stress deformation and strain on the liner system, the emergency tailings would be consolidated by applying a preload fill material on top of the emergency tailings to achieve the required consolidated conditions prior to construction of the Hydrometallurgical Residue Facility.

To achieve this, PolyMet would perform the following tasks:

1. Install a granular drainage layer at the existing LTVSMC Emergency Basin, as needed to facilitate wick drain installation and operation;
2. Install wick drains (if required); and
3. Place, monitor, and remove a preload fill in the existing LTVSMC Emergency Basin to pre-consolidate existing material, thereby reducing future anticipated settlements to mitigate the potential future strains.

In addition to consolidation of the existing LTVSMC emergency tailings, a railroad grade would also be abandoned and removed to facilitate construction.

Seeps have been observed along the southern edge of the LTVSMC Tailings Basin Cell 2W. These seeps have diminished since the termination of the LTVSMC operations and are expected to remain minimal as Cell 2W is not proposed for use as part of the NorthMet Project Proposed Action. The design of the Hydrometallurgical Residue Facility includes a collection drain that would collect water from the seep below the proposed constructed embankment and liner systems to transmit the collected seep to the exterior of the facility. This seepage collection

system would consist of a layer of free draining soil which would reduce the potential for phreatic build-up below the liner.

The double liner and collection system would be installed with the following components, listed in order from top to bottom:

1. Upper geomembrane;
2. Geocomposite (geonet) (for leakage collection and recovery);
3. Lower geomembrane; and
4. Geosynthetic clay liner.

PolyMet initiated laboratory testing to consider the chemical compatibility of the potential geosynthetic liner to be used with leakage from residue (PolyMet 2014r). Results indicated that a polymer-treated geosynthetic liner should be used that is manufactured specifically in anticipation of the chemical characteristics of the liquid and the pore water that would be contained within the facility. The hydraulic conductivity of the leakage collection system is not expected to degrade over time. Typical liner performance assumes a 500 year service life of the geomembrane, therefore, hydraulic conductivity of the liner is not expected to degrade over that time. Specific attributes would be determined during the geosynthetic clay layer development to achieve the desired performance before final installation.

As noted in Section 4.2.14.3.4, the Minnesota Geological Survey has inferred but not confirmed the presence of a north-south trending fault that would underlie the proposed Hydrometallurgical Residue Facility. The potential presence of faults within the footprint of the Hydrometallurgical Residue Facility is not anticipated to have a negative impact on the storage of residue within the double lined facility. A probabilistic seismic hazard analysis was done for the Hydrometallurgical Residue Facility. Results indicated that a severe earthquake is highly unlikely in Minnesota, and any seismically induced forces would not likely affect the stability of the Hydrometallurgical Residue Facility.

Hydrometallurgical Residue Facility Design and Construction

The Hydrometallurgical Residue Facility has been designed as a single cell structure with a design capacity of 6,400,000 cubic yards. The perimeter would have an irregular shape consisting of the north dam (a portion of the existing southern LTVSMC Tailings Basin Cell 2W dam), natural high ground, and new dams (see Figure 5.2.14-4). New dams would be located beyond the extent of the LTVSMC Emergency Basin and founded on existing silty sand, gravel glacial till, and Giants Range granite.

The maximum height of the proposed dams is approximately 85 ft, with a crest elevation of 1,650 ft amsl and an additional 3-ft minimum freeboard (14-ft maximum freeboard at a residue surface slope of 0.5 percent). The exterior, downstream face of the dam would be constructed at a slope of 4H:1V. The interior of the Hydrometallurgical Residue Facility would be sloped at 4H:1V and 30-ft horizontal benches would be placed at elevations of 1,600 and 1,630 ft amsl.

The dams would be constructed using downstream construction methods that involve constructing a smaller starter dam first and then raising the dam upward and outward over the downstream shell of the dam as additional capacity is needed. Construction material would be sourced from natural soil and quarried bedrock between the high ground and south dam. Some

LTVSMC coarse tailings may also be utilized for dam construction. While the material is placed, it would be compacted to the design density.

Materials placed in thin, well-compacted lifts, such as those proposed for the Hydrometallurgical Residue Facility embankment fill, are understood to be sufficiently dense so that liquefaction is not anticipated under the various loading conditions, including the design earthquake event with a peak ground acceleration of 0.024g (2,475 year return period). Although liquefaction of the hydrometallurgical residue (within the basin) may occur, the embankment dam is sufficiently designed so that containment would not be lost. Therefore, the integrity of the facility would not be impacted by the loss of strength associated with potential residue liquefaction.

Closure of the Hydrometallurgical Residue Facility

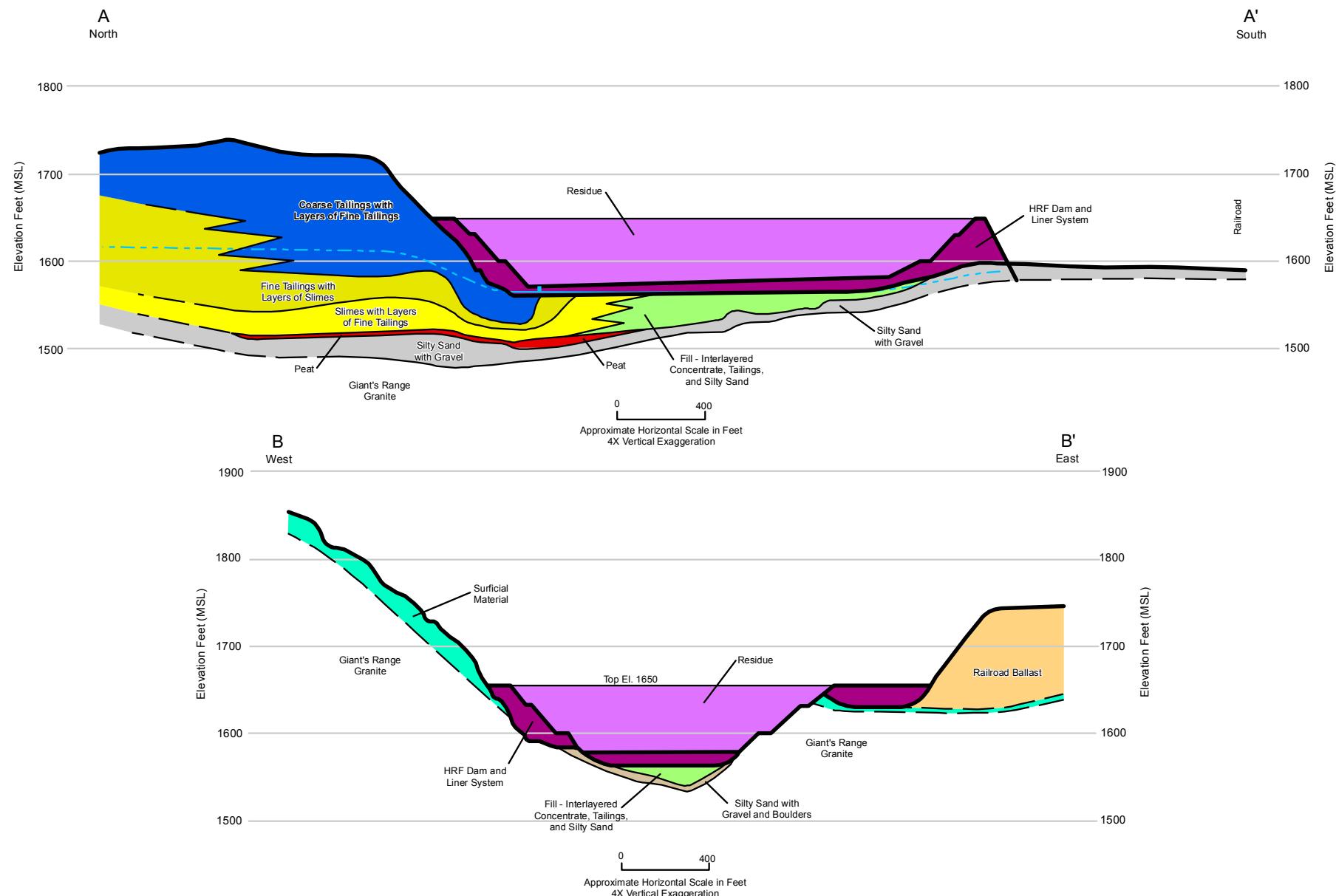
Reclamation of the Hydrometallurgical Residue Facility would include removal of ponded water, removal of pore water from the residue, construction of the cover system, and establishment of vegetation and surface water runoff controls.

Turf and final cover would be inspected and maintained by mowing once per year or as needed, fertilizing when visual inspection indicates poor vegetation growth, and implementing repairs. Additional information relating to closure of the Hydrometallurgical Residue Facility is provided in Section 3.2.2.3.12.

Identification of the Design Cross Section

Cross Section A, depicted in Figure 5.2.14-4, has been identified as the design cross section. It approximates the base of a former ravine, beginning south of the future south dam and terminating near the crest of the Hydrometallurgical Residue Facility north dam. It is considered as the design cross section, as it incorporates the thickest sections of LTVSMC slimes. Fine tailings and slimes in the Emergency Basin are the thickest at approximately 50 ft located 280 ft away from the toe of the south dam of Cell 2W. A cross section of the Hydrometallurgical Residue Facility at its maximum extent along cross sections A and B is shown in Figure 5.2.14-9.

The global slope stability discussed below was assessed along Cross Section A.



Coarse Tailings with Layers of Fine Tailings	Railroad Ballast
Fill - Interlayered Concentrate, Tailings, and Silty Sand	Residue
Fine Tailings with Layers of Slimes	Silty Sand with Gravel
Slimes with Layers of Fine Tailings	Silty Sand with Gravel and Boulders
Peat	HRF Dam and Liner System
	Surficial Material



Figure 5.2.14-9
Cross Sections A and B of the
Hydrometallurgical Residue Facility at Year 20
NorthMet Mining Project and Land Exchange FEIS
Minnesota

November 2015

-Page Intentionally Left Blank-

Modeling Results

The results reported in Geotechnical Data Package Volume 2 indicate that the proposed design of the Hydrometallurgical Residue Facility would meet all respective Factors of Safety as required (PolyMet 2014c). The modeling undertaken and results are summarized below.

Stress Deformation and Strain in the Liner System

A preload would be placed on the existing LTVSMC Emergency Basin to consolidate the foundation materials before construction of the Hydrometallurgical Residue Facility. Wick drains may be used to help accelerate the consolidation time by increasing the effective hydraulic conductivity of the tailings due to decrease in flowpath length. Some portion of this load would be removed before construction, and the remaining material would be graded to provide sufficient drainage slope and provide a suitable foundation material for the facility. The material would rebound a small amount after the preload is removed. The aggregate settlement at a representative location within the Emergency Basin, considering the maximum anticipated tailings thickness in the foundation, is computed to be 3.9 ft. The material at this location is modeled to consolidate an additional 1.4 ft by the end of operations of the Hydrometallurgical Residue Facility.

Residue consolidation within the basin is modeled as beginning after the cessation of residue discharge to the Hydrometallurgical Residue Facility. Over time, the rate of consolidation would decrease with the greatest amount of consolidation occurring before pore-water pressure reaches hydrostatic equilibrium (approximately 10 years following closure). Total settlement in areas with the greatest depth of residue is estimated to be on the order of 9.6 ft. As the depth of residue decreases near the edge of the Hydrometallurgical Residue Facility, less settlement would occur. The resulting deformed surface of the Hydrometallurgical Residue Facility would be concave with the greatest deformation in areas of greatest residue thickness.

Strain in the Hydrometallurgical Residue Facility liner system would result from differential settlement in the facility foundation between points along the liner. The maximum strain in the liner system is estimated to be 0.20 percent. This value is well within acceptable limits of most geosynthetics, which range from 1 to 19 percent.

Global Slope Stability

Analysis of the new dams (i.e., those not supported by the existing LTVSMC Tailings Basin or natural topography) at their greatest height (at year 20) resulted in a computed Factor of Safety for the ESSA of 2.32, which is greater than the required minimum of 1.5. Because the friction angle for the dam fill material (approximately 30 degrees) is greater than the proposed dam downstream slope angle (18 degrees), significant surficial slope failures are not expected.

Liquefaction analysis was not applicable and not performed because the material proposed in the constructed dams would be well-compacted and the Hydrometallurgical Residue Facility liner system would limit leakage through the dams. Therefore, the embankment is not anticipated to be saturated during and after operations.

Infinite Slope Stability

The components of the double liner system are designed to act as hydraulic barriers to leakage; not as structural members of the dam system. Therefore, the liner layers must not be allowed to

slide relative to one another. Evaluation of this potential for sliding was performed using infinite slope stability analyses. The minimum infinite slope stability Factor of Safety for all Hydrometallurgical Residue Facility liner system components is 1.5.

The interior slope angle for the Hydrometallurgical Residue Facility and the geosynthetic materials of the liner that would directly contact the underlying soils used for dam construction must be selected to produce a stable liner system—a system that would not slide down-slope during operations. In addition, each successive layer of the liner system must have an adequate interface-friction angle with the adjacent layer to prevent down-slope movement of any layer of the liner system. Infinite slope stability for the liner system layer interface configurations currently expected is shown in Table 5.2.14-2. Computed Factors of Safety shown in Table 5.2.14-2 are based on commonly reported interface friction angles between the materials anticipated to be used for the Hydrometallurgical Residue Facility liner. Any variation from the anticipated material types warrants project-specific interface shear testing to confirm that the friction angles are equal to or greater than those used in this analysis.

Shear failure in the geosynthetic clay/geomembrane liner systems would occur at the interface with the lowest peak shear strength. On the basis of the interface friction angles used in the analysis, the design proposed for the Hydrometallurgical Residue Facility achieves a computed Factor of Safety of 2.94.

Table 5.2.14-2 Infinite Slope Stability Analysis Results for the Hydrometallurgical Residue Facility

Interface Number	Material Types	Slope Angle, (deg)	Predicted friction Angle, (deg)	Minimum required Factor of Safety	Predicted Factor of Safety
4	Textured Geomembrane above Geocomposite Drainage Net	15.95	28	1.5	1.86
3	Geocomposite Drainage Net above Textured Geomembrane	15.95	28	1.5	1.86
2	Textured Geomembrane above Geosynthetic Clay Liner	15.95	28	1.5	1.86
1	Geosynthetic Clay Liner above Granular Soil	15.95	24	1.5	1.56

Proposed Monitoring, Maintenance, and Mitigation

A Hydrometallurgical Residue Management Plan (PolyMet 2014r) prepared by PolyMet includes a description of the operating plans, monitoring procedures, and adaptive management approaches for the Hydrometallurgical Residue Facility.

Monitoring and maintenance for the Hydrometallurgical Residue Facility would be similar to that discussed for the Tailings Basin at the end of Section 5.2.14.2.2 above.

Construction quality control and assurance would occur throughout construction of the Hydrometallurgical Residue Facility, beginning with regulatory agency review and approval of the construction quality control and assurance plan. A Construction Quality Assurance Manual template for the installation of the soil and geosynthetic components of liner and cover systems

has been drafted to addresses QA/QC procedures for earthwork, geomembrane and geosynthetic clay liner installation, and piping components of the HRF double liner and leakage collection system, drainage collection system, and cover system (PolyMet 2014r). Upon completion of construction, a construction documentation report would be prepared to document that construction of the Hydrometallurgical Residue Facility was completed in conformance with regulatory agency permit requirements.

A Contingency Action Plan has been prepared as part of the Residue Management Plan (PolyMet 2014r). The plan provides guidance to on-site personnel and emergency responders in the case of unplanned occurrences at the Hydrometallurgical Residue Facility.

5.2.14.3 NorthMet Project No Action Alternative

Under the No Action Alternative, no waste rock stockpiles, or expanded Tailings Basin, or Hydrometallurgical Residue Facility would be created. The existing geotechnical conditions are discussed in Section 4.2.14. The existing LTVSMC Tailings Basin as discussed in Section 4.2.14 would remain at the site and monitoring and inspection would continue under the LTVSMC site closure plan and the MDNR Dam Safety regulations.

-Page Intentionally Left Blank-

5.3 LAND EXCHANGE

5.3.1 Land Use

The Land Exchange Proposed Action represents a transfer of surface rights of 6,495.4 acres from the Superior National Forest to PolyMet to eliminate the conflict between federal surface and private mineral estate. This action would remove those acres from Superior National Forest management and public use. The Land Exchange Proposed Action would remove these acres, which are part of the 1854 Ceded Territory, from lands available to the Bands to exercise reserved 1854 Treaty rights. Given the existing lack of overland public access and the current and historic use of the federal lands for mineral exploration (see Section 4.2.9), the Land Exchange Proposed Action represents little to no change in the actual level of recent or current use of the federal lands. At the same time, the Land Exchange Proposed Action brings as many as 7,075.0 acres of private land into the public domain, making it available for the Bands to exercise 1854 Treaty rights (see Section 4.3.9).

When compared with the Land Exchange No Action Alternative, the Land Exchange Proposed Action and the Land Exchange Alternative B would provide a slight improvement in key indicators described in Section 5.3.1.1. The Land Exchange Proposed Action provides for more of an improvement in overall indicators than under the Land Exchange Alternative B. The Land Exchange Proposed Action and the Land Exchange Alternative B are both compatible with adjacent zoning and management area designations.

There is no current legacy contamination on the non-federal parcels. Past legacy contamination concerns are discussed in Section 4.3.1.

5.3.1.1 Methodology and Evaluation Criteria

The area of analysis for land use effects from the Land Exchange Proposed Action included the federal and non-federal tracts, as well as properties abutting the tracts, which provide the basis for determining compatibility of land uses on the federal and non-federal parcels. The temporal analysis is based on the time of change in ownership. Management areas and subsequent land uses would be established at the time of the ownership change.

The analysis of the land use resources affected by the Land Exchange Proposed Action was guided by evaluation criteria that were developed by the USFS and the other Co-lead Agencies. The following impact indicators identify anticipated outcomes of the Land Exchange Proposed Action alternatives being considered for the NorthMet Project Proposed Action:

- Net change in the number of acres controlled by the USFS on the Superior National Forest;
- Net change in the length of the boundary around USFS-controlled land in the Superior National Forest (including internal boundaries around private in-holdings) to be managed under each of the proposed alternatives;
- Net change in the level of land fragmentation, expressed as a ratio of linear boundary-to-area (linear miles per acre) of the USFS-controlled portions of the Superior National Forest under each of the proposed alternatives;

- The degree of access to lands owned by the USFS in the Superior National Forest, as determined through the identification of public access points via road or trail;
- Degree of compatibility between USFS management areas and zoning or land use designations (in the absence of zoning) of adjacent areas;
- Potential for mineral development within the parcels, assessed by the USFS based on mineral ownership, the type of mineral, and the precedent/history for exploitation of this mineral within Minnesota; and
- Quality of title within each of the parcels being considered. Quality was evaluated by the USFS according to outstanding encumbrances on the parcels considered for each of the Land Exchange Proposed Action alternatives, including mineral ownership and development potential.

Quantitative criteria, such as boundary length and land area, were calculated using GIS. Evaluations of mineral development potential were conducted by third party professional geologists (Barr 2011c). The risk of conflict between mineral interests and USFS surface management and quality of title were assessed by a USFS Forest Realty Specialist.

5.3.1.2 Land Exchange Proposed Action

5.3.1.2.1 Forest Available for Public Access and Use

Through the Land Exchange Proposed Action, 6,495.4 acres of federal lands in the Superior National Forest would be transferred to PolyMet in exchange for up to approximately 7,075.0 acres of non-federal lands presently in private ownership. This would result in a net increase of up to 579.6 acres for the Superior National Forest.

All of the non-federal lands are within the 1854 Ceded Territory and would thus be subject to Treaty rights reserved by the Bands as a result of the Land Exchange Proposed Action. This would result in a net increase of up to 579.6 acres of publicly owned land in the 1854 Ceded Territory. Table 5.3.1-1 shows the Management Area designations that the USFS would apply to the non-federal lands under the Land Exchange.

Table 5.3.1-1 Management Area Allocations under the Land Exchange Proposed Action

Tract	Acreage by Management Area ¹				
	General Forest	General Forest-Longer Rotation	Riparian Emphasis Areas	cRNA ⁵	Total ⁶
Federal Lands²	355.3	6,140.1	0.0	0.0	6,495.4
Non-federal Lands³					
Tract 1	4,619.3	0.0	0.0	306.9	4,926.2
Tract 2	0.0	161.0	220.9	0.0	381.9
Tract 3	1,450.0	125.8	0.0	0.0	1,575.8
Tract 4	0.0	160.2	0.0	0.0	160.2
Tract 5	0.0	30.8	0.0	0.0	30.8
Subtotal, Non-federal Lands	6,069.3	477.8	220.9	306.9	7,075.0
Net Increase/(Decrease)⁴	5,714.0	(5,662.3)	220.9	306.9	579.6

Notes:

¹ See definitions of USFS Management Areas in Section 4.2.3.

² Source: USFS 2011a.

³ Source: USFS 2011b.

⁴ Calculated as (non-federal) minus (federal).

⁵ Candidate Research Natural Area (see Section 4.2.3).

⁶ Totals may not match overall NorthMet Project area acreages due to rounding.

The 6,495.4 acres of federal lands are not accessible for public use via land (see Section 4.2.11), while substantial portions of the non-federal lands do have public access via public roads or hiking trails. This distinction is a factor in evaluating land use effects, because public access defines the degree to which the lands in question can actually be used—either by the public for recreational purposes, by forestry interests for economic purposes, or for research and conservation purposes (in the case of Riparian Emphasis and cRNA management areas, defined in Section 4.3.1). Tract 1 has direct public access via existing county roads (see Figure 5.3.1-1), and Tract 4 has public access via other roads (see Figure 5.3.1-2). Tracts 2 and 3 have no direct public access (see Figure 5.3.1-1). When considered collectively, public access to, and therefore use of the Superior National Forest, would be increased under the Land Exchange Proposed Action.

Table 5.3.1-2 shows the effect of the Land Exchange Proposed Action on the total acreage within the Superior National Forest that is controlled by the USFS, the boundary of the USFS-controlled land (see Section 5.3.1.2.2), and the fragmentation ratio (see Section 5.3.1.2.3). The Land Exchange Proposed Action would increase the federal estate by adding a net of 385.1 acres to the 2,171,603.9 acres of USFS-controlled land within the Superior National Forest.

Table 5.3.1-2 Superior National Forest Boundary, Acreage, and Fragmentation under the Land Exchange Proposed Action

Baseline / Land Exchange No Action Alternative	Land Exchange Proposed Action	
	Predicted Value	Net Increase/ (Decrease) ¹
Acreage in Superior National Forest controlled by USFS	2,171,603.9	2,171,989.0
Boundary length (linear miles)	10,054.8	10,021.6
Fragmentation (linear miles per acre)	0.005	0.005
		0.00

Note:

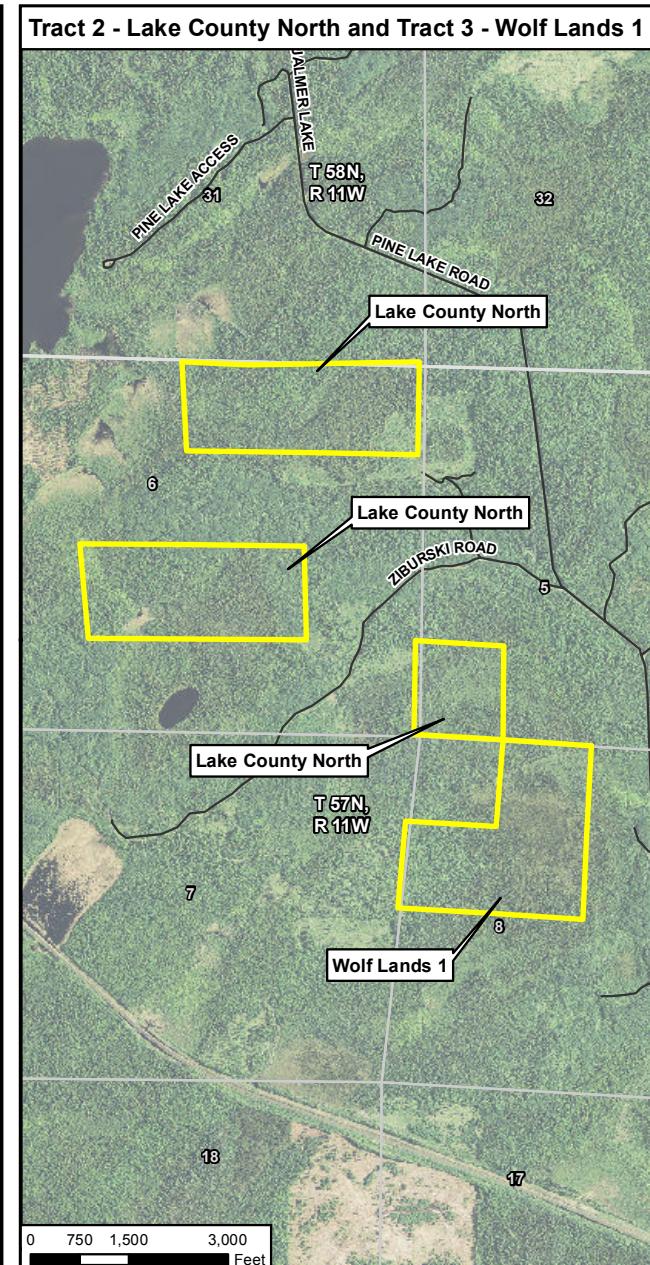
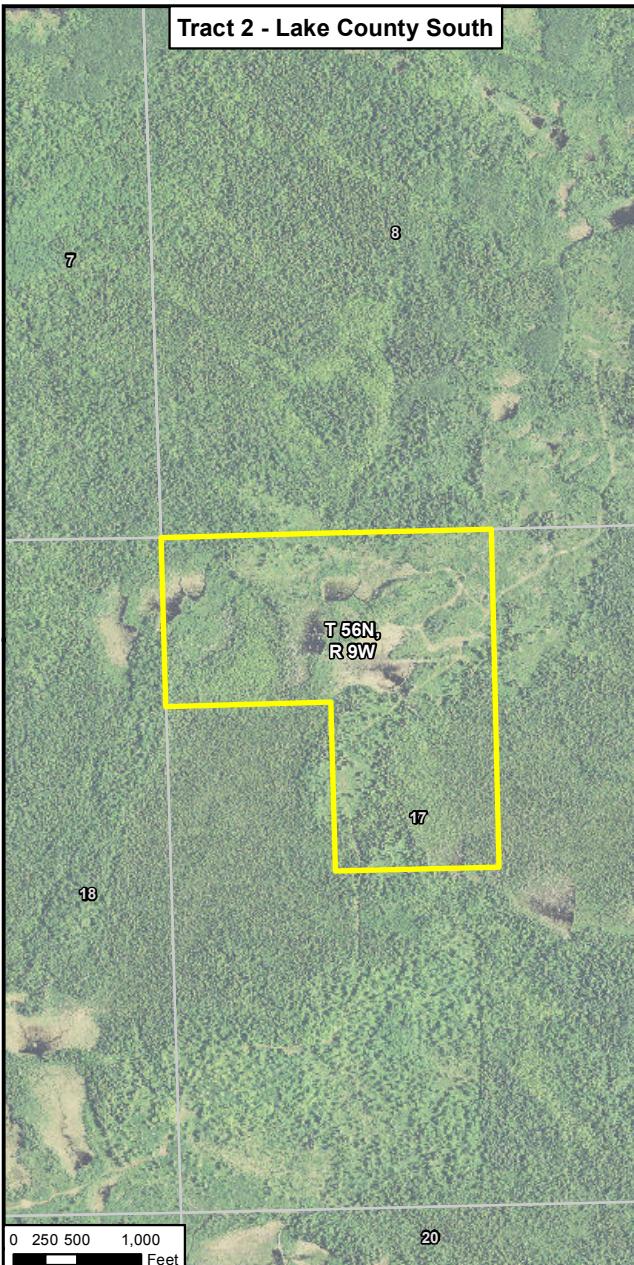
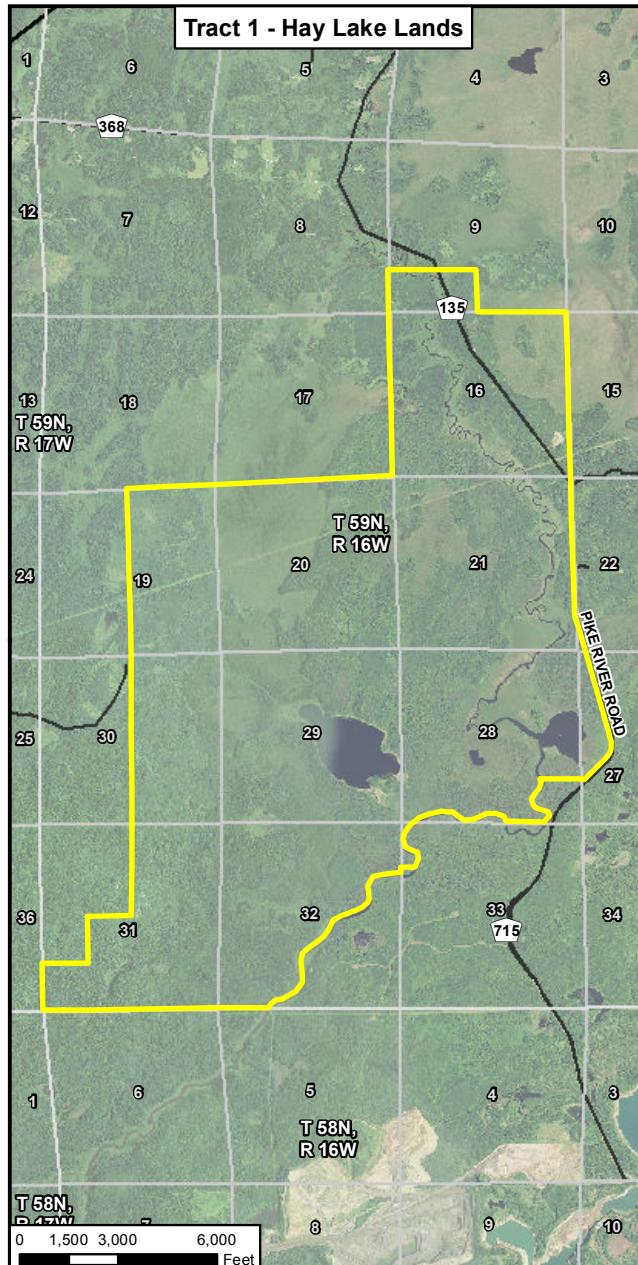
¹ Totals differ from acreage reported in Section 5.3.1.2.1 (579.6 acres) due to inconsistencies in GIS data and because Mud Lake (30.5 acres) would continue to be managed by the MDNR.

5.3.1.2.2 Boundary Managed

A reduced boundary length is more desirable for the USFS, because it reduces the difficulty of accessing and managing the forest. The Land Exchange Proposed Action would result in a 33.2-linear mile net reduction of the perimeter around the USFS-controlled portions of the Superior National Forest (see Table 5.3.1-2).

5.3.1.2.3 Forest Fragmentation

The underlying assumption regarding land fragmentation of USFS-controlled portions of the Superior National Forest is that a lower ratio of boundary to area is more desirable, because it reduces the difficulty of accessing and managing the forest in addition to increasing the forest's overall quality and function. All of the non-federal parcels are contiguous with National Forest System lands, thus decreasing the ratio of boundary to area. This reduction would be marginal in magnitude, and the Land Exchange Proposed Action would not alter the existing ratio of fragmentation in the Superior National Forest of approximately 0.005 linear mile of boundary per acre of USFS-controlled Superior National Forest land (see Table 5.3.1-2).



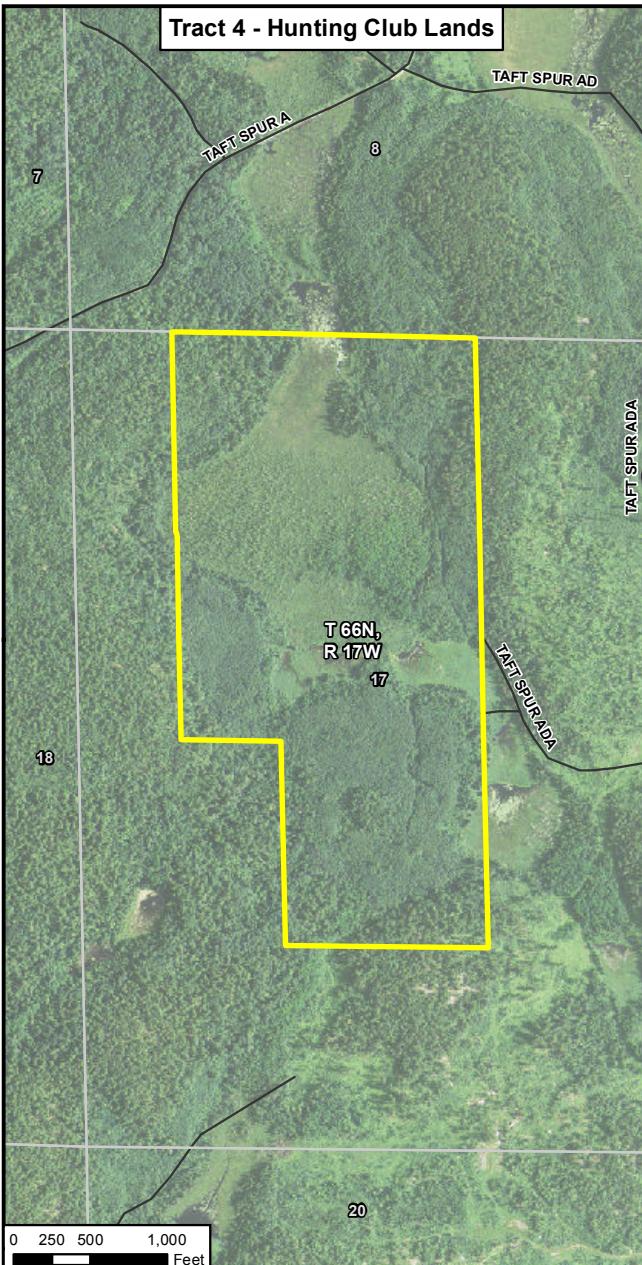
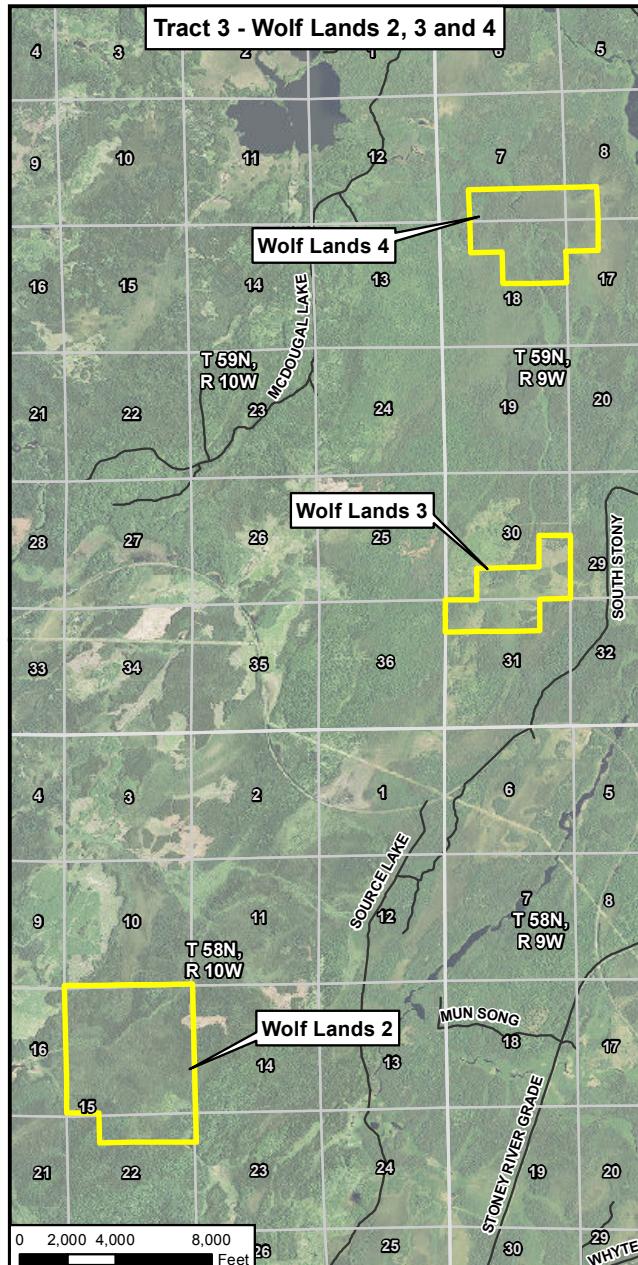
- Non-federal Lands
- Section Boundary
- Section Label
- Road



Figure 5.3.1-1
Tracts 1, 2, and 3 Roads
NorthMet Mining Project and Land Exchange FEIS
Minnesota

November 2015

-Page Intentionally Left Blank-



- Non-federal Lands
- Section Boundary
- 1 Section Label
- Road



Figure 5.3.1-2
Tracts 3, 4, and 5 Roads
NorthMet Mining Project and Land Exchange FEIS
Minnesota

November 2015

-Page Intentionally Left Blank-

5.3.1.2.4 Zoning Compatibility

Management area designations establish USFS policy for public use of National Forest System lands (e.g., recreation, scenic resources, and facilities). Section 4.3.1 provides definitions of the intended uses of the management area designations that apply to the federal and non-federal tracts, as well as surrounding areas within the Superior National Forest.

Zoning in areas adjacent to the non-federal lands outside of the Superior National Forest and compatibility with the management area designations of non-federal lands are summarized below:

- Zoning on privately owned (“non-forest”) lands adjacent to Tract 1 is split among multiple zoning districts that collectively provide for residential development, wild rice production, timber, and hunting (St. Louis County 2011). With the exception of residential development and timber, these uses are generally compatible with the proposed General Forest Management Area designation of Tract 1. Recreational uses such as personal-use riding and hunting would be consistent with the cRNA designation. Non-forest lands to the east and south of Tract 1 are in the Multiple-Use Non-Shoreland (MUNS-4) district (St. Louis County 2011), which is generally compatible with the General Forest and cRNA management areas.
- Non-forest lands adjacent to Tracts 2 and 3 are in the Forest-Recreation district, as defined by the Lake County Zoning Ordinance (ERM, Pers. Comm., October 10, 2011). This is compatible with the proposed General Forest, General Forest – Longer Rotation, and Riparian Emphasis Area Management Area designations.
- Non-forest lands adjacent to Tract 4 to the west and southeast are within the St. Louis County FAM-1 zoning district, which emphasizes forestry, agricultural, and recreational uses (St. Louis County 2011). These uses are generally compatible with the proposed General Forest – Longer Rotation Management Area designation.
- Privately owned lands adjacent to Tract 5 to the north and southeast are within Cook County’s Recreational Development zoning district (Cook County 2011), which is generally compatible with the proposed General Forest – Longer Rotation Management Area.

Overall, the management area designations of the non-federal lands are compatible with surrounding zoning. The Land Exchange Proposed Action would be compatible with the USFS Management Areas and zoning/land use designations of adjacent lands.

5.3.1.2.5 Mineral Development Potential and Quality of Title

The Land Exchange Proposed Action would remove from the Superior National Forest 6,495.4 acres of land with privately held, minable mineral development potential and USFS-held surface rights, in exchange for up to 7,075.0 acres of non-federal land with a low mineral development potential. As described in Section 3.3, the Land Exchange would eliminate conflict between mineral estate and surface rights on the federal lands by transferring the federal surface to the holder of the private mineral rights, fulfilling the USFS’s purpose and need.

Table 5.3.1-3 summarizes the risk of conflict between mineral potential and the USFS surface management objectives on each of the non-federal parcels, as well as the overall quality of title to the land.

Table 5.3.1-3 Mineral Interests and Quality of Title for Non-Federal Lands

Tract/Parcel	Risk of Conflict Between Mineral Interests and USFS Surface Management ¹	Quality of Title ^{2,3}
1: Hay Lake	Moderate	Moderate
2: Lake County North	Low	Moderate
2: Lake County South	Low	Moderate
3: Wolf Lands 1	Low	Moderate
3: Wolf Lands 2	Low	Moderate
3: Wolf Lands 3	Low	Moderate
3: Wolf Lands 4	Low	Moderate
4: Hunting Club	Low	High
5: McFarland Lake	Low	Moderate

Source: USFS 2011c.

Notes:

¹ Low is the best and high is the worst, as defined in USFS 2011c and Barr 2011c.

² Condition of title represents review as of December 21, 2011 -- may be revised per specialist investigation or advice of USDA, Office of General Counsel.

³ High is the best and poor is the worst, as defined in USFS 2011c.

The risk of conflict determination in Table 5.3.1-3 expresses the degree to which “split estate” conditions could complicate achievement of USFS management goals and objectives. Split estate refers to situations where private ownership of mineral rights would occur on land whose surface is owned by the Superior National Forest after the Land Exchange Proposed Action. This concern notwithstanding, the USFS allows exploration, development, and production of mineral resources on National Forest System lands under conditions where the activities “are conducted in an environmentally sound manner so that they may contribute to economic growth and national defense” (USFS 2004b).

The “moderate” risk of conflict on Tract 1 reflects the presence of potential surficial aggregate resources in the far northeastern corner of the tract. There are also some potential surficial aggregate resources near Greenwood Lake in Tract 3, but development of these resources is constrained due to the presence of wetlands, which may limit or prohibit access (Barr 2011c). For all other tracts, the risk of conflict is low due to the low potential for mineral development.

The quality of title determination assesses existing uncertainties in surface ownership, title insurance, or other encumbrances that may be transferred to the USFS in the event of the Land Exchange moving forward, as well as the risk of conflict defined above. Details of the quality of title determination are presented below by tract (USFS 2011c):

- Tract 1: Moderate, due to the presence of surficial aggregate resources in the northeastern portion of the site and certain title encumbrances that may be cured by endorsements in the final title insurance policy.
- Tract 2: Moderate, due to the presence of privately held mineral exploitation rights. This potential is constrained by the low potential presence of subsurface mineral resources and the absence of surficial deposits.
- Tract 3: Moderate, due to the presence of privately held mineral exploitation rights on portions of all Tract 3 parcels and the presence of private timber rights for one parcel. Mining potential is constrained by the low potential presence of subsurface mineral resources, the

absence of surficial deposits, and the presence of wetlands that may make mineral exploitation difficult.

- Tract 4: High, because the mineral estate was never severed from this parcel.
- Tract 5: Moderate, due to the potential for privately held mineral exploitation rights. This potential is constrained by the low potential presence of subsurface mineral resources and the absence of surficial deposits.

By comparison, the risk of conflict between mineral and surface rights on the federal lands is high due to the presence of privately owned mineral rights and economically developable minerals and USFS surface ownership. The Land Exchange Proposed Action would reduce this risk by exchanging the high-risk federal lands for predominantly low-risk non-federal lands. The risk of conflict on the non-federal lands may be reduced and title quality further improved through subsequent arrangements with holders of mineral rights on the non-federal lands or affirmative title insurance coverage. Thus, the overall effect of the Land Exchange Proposed Action improves the quality of title and reduces the complexity of title to the federal and non-federal lands.

5.3.1.3 Land Exchange Alternative B

5.3.1.3.1 Forest Available for Public Access and Use

Under the Land Exchange Alternative B, 4,752.6 acres of federal lands would be transferred to private ownership in exchange for up to approximately 4,926.3 acres of land (Tract 1 only), as determined by appraisals. This land is currently in private ownership, resulting in a net increase of approximately 173.6 acres for the Superior National Forest. The federal lands transferred out of the Superior National Forest in this scenario have poor public access (see Section 4.3.11). The smaller federal parcel would leave an isolated island of federal lands to the west of the Mine Site. These federal lands would be difficult to access because the railroad and road are private property. Access points managed by the USFS to the isolated area are limited. The non-federal tract has relatively good public access. Land Exchange Alternative B would result in a net increase of up to 173.6 acres for the Superior National Forest. All of Tract 1 is within the 1854 Ceded Territory and would thus be available for exercise of 1854 Treaty rights reserved by the Bands. Table 5.3.1-4 shows the Management Area designations that the USFS would apply to Tract 1 under Land Exchange Alternative B.

Table 5.3.1-4 Management Area Allocations under Land Exchange Alternative B

Tract	Acreage by Management Area ¹					Total⁶
	General Forest	General Forest- Longer Rotation	Riparian Emphasis Areas	cRNA⁵		
Federal lands²	355.3	4,397.3	0.0	0.0	0.0	4,752.6
Non-federal lands³						
Tract 1	4,619.3	0.0	0.0	306.9	4,926.2	
Net Increase/(Decrease)⁴	4,264.0	(4,397.3)	0.0	306.9	173.6	

Notes:

¹ See definitions of USFS Management Areas in Section 4.2.3.

² Source: USFS 2011a.

³ Source: USFS 2011b.

⁴ Calculated as (non-federal) minus (federal).

⁵ Candidate Research Natural Area (see Section 4.2.3).

⁶ Totals may not match overall project area acreages due to rounding.

Table 5.3.1-5 shows the effect of the Land Exchange Alternative B on the total acreage within the Superior National Forest that is controlled by the USFS, the boundary of the USFS-controlled land (see Section 5.3.1.4.2), and the fragmentation ratio (see Section 5.3.1.4.3). The Land Exchange Alternative B would increase the federal estate by a net of 38.7 acres to the 2,171,603.9 acres of USFS-controlled land within the Superior National Forest.

Table 5.3.1-5 Superior National Forest Boundary, Acreage, and Fragmentation for Land Exchange Alternative B

Baseline/ Land Exchange No Action Alternative	Land Exchange Alternative B	
	Predicted Value	Net Increase/(Decrease)¹
Acreage in Superior National Forest controlled by USFS	2,171,603.9	2,171,642.6
Boundary length (linear miles)	10,054.8	10,046.2
Fragmentation (linear miles per acre)	0.005	0.005

Note:

¹ Totals differ from acreage reported in Table 5.3.1-4 (173.6 acres) due to inconsistencies in GIS data and because Mud Lake (30.5 acres) would continue to be managed by the MDNR.

5.3.1.3.2 Boundary Managed

The Land Exchange Alternative B would result in an 8.6-mile net reduction of the perimeter around the USFS-controlled portions of the Superior National Forest (see Table 5.3.1-5).

5.3.1.3.3 Forest Fragmentation

The Land Exchange Alternative B would not change the fragmentation ratio in USFS-controlled portions of the Superior National Forest (see Table 5.3.1-5).

5.3.1.3.4 Zoning Compatibility

Under the Land Exchange Alternative B, the forest lands that would become isolated under this alternative to the west of the smaller federal parcel would remain within the Superior National

Forest, and would retain their General Forest – Longer Rotation Management Area designation. This management area is compatible with nearby mining activity. There is no existing public access to this portion of the Superior National Forest, and it is reasonable to expect that permission of the private landowner to access the land would be restricted, for health and safety reasons, for the anticipated life of the mine.

The proposed management area designation for Tract 1 under the Land Exchange Alternative B would be the same as in the Land Exchange Proposed Action (see Section 5.3.1.2.4). The Land Exchange Alternative B would be compatible with the USFS management areas and zoning/land use designations of adjacent lands.

5.3.1.3.5 Mineral Development Potential and Quality of Title

The Land Exchange Alternative B would remove 4,752.6 acres of forest lands with proven mineral development potential from the Superior National Forest, in return for up to 4,926.3 acres with moderate mineral development potential, except for potential surficial aggregate resources in the far northeastern corner of Tract 1 (Barr 2011c). The risk of conflict and quality of title for the Land Exchange Alternative B is the same as for Tract 1 in the Land Exchange Proposed Action (see Table 5.3.1-3).

As with the Land Exchange Proposed Action, the Land Exchange Alternative B would result in a reduced risk of conflict and improved quality of title. The Land Exchange Alternative B would result in relinquishing the federal parcel with severed, private mineral rights and known, economically developable minerals and acquiring parcels with low to moderate risk of conflict and moderate to high title quality. The risk of conflict and title quality may be further improved through subsequent arrangements with holders of mineral rights on the non-federal lands or affirmative title insurance coverage. Thus, the Land Exchange Alternative B would also benefit efforts to manage the Superior National Forest, although to a lesser degree than the Land Exchange Proposed Action.

Mineral rights to the Mine Site are held by PolyMet, while surface rights are held by USFS, creating a conflict between surface and mineral rights. As described in Section 3.3, the USFS's Purpose and Need is to resolve the conflict between surface and mineral rights (see Section 5.3.1).

The Land Exchange Alternative B would be consistent with this Purpose and Need, as well as existing land use designations surrounding the Mine Site. Therefore, the Land Exchange Alternative B would have no adverse effect on land use at the Mine Site. Effects on recreational and natural resource use at the Mine Site are addressed in other sections of this chapter.

5.3.1.4 Land Exchange No Action Alternative

The Land Exchange No Action Alternative represents no change to current land use on the federal and non-federal lands. There would be no change in the amount of forest boundary managed, level of forest fragmentation, or acres available for public access and use.

Under the Land Exchange No Action Alternative, interest in development of mineral potential on the federal lands could continue, and would be compatible with relevant local zoning ordinances and planning designations. The Land Exchange No Action Alternative is also compatible with the General Forest and General Forest – Longer Rotation Management Area classifications.

However, the mineral rights would remain severed from federal ownership. The potential conflict between mineral interests and USFS surface management of the federal parcel would remain.

The presence of a privately owned road (Dunka Road) and rail on the southern border of the federal lands would continue to limit public access to and use of the federal lands, as envisioned by the management area designations.

5.3.2 Water Resources

This section describes the potential effects and compares the resource value of the Land Exchange Proposed Action on water resources of the federal and non-federal lands to be exchanged, as well as for Land Exchange Alternative B and the Land Exchange No Action Alternative. The effects on the federal and non-federal lands are discussed together to facilitate comparison between the water resources of the lands exchanged. The total yield and quality of surface and groundwater currently leaving the non-federal tracts and flowing into the federal estate would not be altered by any of the Land Exchange alternatives. Under the Land Exchange Proposed Action and alternatives, the Superior National Forest would retain its ongoing responsibility for managing water resources on USFS lands in accordance with the Forest Plan. Table 5.3.2-1 shows the effects of the Land Exchange Proposed Action and Land Exchange alternatives on acreage of surface water and wild rice beds.

Under the Land Exchange Proposed Action, a net increase of 95.2 acres of MDNR-designated public water lakes (2.1 miles of shoreline) and 4.6 miles of public water streams would be added to the federal estate. By comparison, under Land Exchange Alternative B, a net increase of 116.8 acres of public water lakes (2.6 miles of shoreline) and 3.6 miles of public water streams would be added to the federal estate. One difference is that, under the Land Exchange Proposed Action, all of Mud Lake (30.5 acres) would be exchanged for the private lands, while under Land Exchange Alternative B only about 8.9 acres of Mud Lake would be included in the land exchange.

Both the Land Exchange Proposed Action and Land Exchange Alternative B would result in a net increase of wild rice beds to the federal estate. The federal lands do not contain any known wild rice beds, but Hay Lake Lands (Tract 1) contain known wild rice beds (approximately 126 acres). No wild rice beds would be affected as a result of the Land Exchange Proposed Action or Land Exchange Alternative B as no activities are proposed on the non-federal lands and the proposed mining activities would not affect these lands. Furthermore, though the Land Exchange Proposed Action would result in an increase in wild rice stands within the federal estate boundaries, there would be no change to the wild rice harvest opportunities for the public due to the Land Exchange Proposed Action or the Land Exchange Alternative B.

Table 5.3.2-1 Net Change in Surface Water and Wild Rice Beds to the Federal Estate under the Land Exchange Proposed Action and Alternatives

Alternative	Net Increase/(Decrease) of Water Resources			
	Public Water		Public Water Streams (miles)	Wild Rice Beds (acres) ¹
	Lakes (acres)	Lakes (miles of shoreline)		
Land Exchange Proposed Action	95.2	2.1	4.6	>125.7 ⁽²⁾
Land Exchange Alternative B	116.8	2.6	3.6	>125.7 ⁽²⁾
Land Exchange No Action Alternative	0	0	0	0

Notes:

¹ Wild rice beds within the Land Exchange Proposed Action and the Land Exchange Alternative B boundaries are currently, and would continue to be, located in MDNR-designated public waters.

² Excludes area of wild rice beds in Pike River. Presence of wild rice in the Pike River, which runs through Rice Lake, was noted in Barr's surveys (2011a; 2012a; 2013l), but the area of rice was not calculated.

There is limited groundwater or surface water quality data available for the non-federal tracts, with the exception of sulfate data for the Hay Lake Lands. There are, however, no known reasons to suspect surface water or groundwater contamination of any of the tracts from human activities. In general, water quality is expected to reflect natural conditions as similar to that found from MPCA regional studies (see Section 4.3.2.2.3).

5.3.2.1 Methodology and Evaluation Criteria

The area of analysis for water resource effects of the Land Exchange alternatives included the federal and non-federal tracts proposed for the exchange.

Since the Land Exchange Proposed Action would not actually result in any direct effects, as there are no construction or other activities proposed that would affect water resources, this assessment focuses on a comparison of the net change in the quantity and quality of water resources between the federal and non-federal tracts involved in the exchange.

5.3.2.1.1 Groundwater Evaluation Criteria

Groundwater resource evaluation criteria for the Land Exchange Proposed Action include a qualitative assessment of potential for groundwater contamination of the non-federal properties using MDNR and MPCA groundwater quality data.

5.3.2.1.2 Surface Water and Wild Rice Evaluation Criteria

Surface water evaluation criteria for the Land Exchange Proposed Action include a comparison of the length of public water streams/rivers, public water lake acreage, and shoreline length between the federal and non-federal lands. This was used to determine the net change in quantity of waterbodies. In addition, a qualitative assessment of surface water quality was conducted taking into consideration available water quality data, aerial photographs, and GIS information.

Wild rice evaluation criteria include a comparison in the amount of known or potential wild rice beds between federal and non-federal lands. This was used to determine the potential change in

acres of wild rice on the federal estate. Information that was used in the analysis of wild rice beds included available field data, aerial photographs, and GIS layers.

5.3.2.2 Land Exchange Proposed Action

The Land Exchange Proposed Action would involve the transfer of 6,495.4 acres of federal lands from public to private ownership, and up to 7,075.0 acres of private land to public ownership (see Figure 3.3-1).

5.3.2.2.1 Groundwater

The Land Exchange Proposed Action would not directly result in a change in groundwater quantity or quality presently at the non-federal tracts. Evaluation of existing hydrogeologic data did not suggest the potential for groundwater contamination from human activity from any of the tracts. Therefore, there does not appear to be any substantive difference in the quality of groundwater resources between the federal and non-federal tracts.

5.3.2.2.2 Surface Water and Wild Rice

The Land Exchange Proposed Action would not directly result in a change in surface water quantity or quality at the non-federal tracts. There would be a net increase to the federal estate of 4.6 miles of public water streams and 95.2 acres of public water lakes (including 2.1 miles of additional shoreline).

No wild rice stands are known to occur on the federal lands, and suitable habitat is limited. The non-federal lands that contain wild rice beds would not be affected as a result of the Land Exchange Proposed Action or Land Exchange Alternative B, because no activities are proposed on these lands and the proposed mining activities would not affect these lands. As noted in the FEIS, the Land Exchange Proposed Action would result in a net increase of 125.7 acres of wild rice beds to the federal estate. FEIS Sections 5.3.2 and 5.3.4 clarify that, although the Land Exchange would result in an increase in wild rice stands within the federal estate boundaries, there would be no change to the existing public access to Tract 1 wild rice stands via the Pike River. Consequently, there would be no increase in wild rice harvest opportunities for the public.

Table 5.3.2-2 summarizes the federal and non-federal surface water resources and shows the net changes in these resources to the federal estate that would result from the Land Exchange Proposed Action. The Hay Lake lands (Tract 1) account for the majority of the net gain in surface water and wild rice beds to the federal estate from all the non-federal lands.

Table 5.3.2-2 Net Change in Surface Water and Wild Rice Beds to the Federal Estate under the Land Exchange Proposed Action

	Surface Water Resource			
	Public Water Lakes (acres)	Public Water Lakes (miles of shoreline)	Public Water Streams (miles)	Wild Rice Beds (acres) ¹
		Lands Conveyed		
Federal Lands	30.5	0.9	4.5	0.0
Lands Acquired				
Tract 1 – Hay Lake	125.7	2.8	8.1	>125.7 ⁽²⁾
Tract 2 – Lake County	0.0	0.0	0.0	0.0
Tract 3 – Wolf Lands	0.0	0.0	1.0	0.0
Tract 4 – Hunting Club	0.0	0.0	0.0	0.0
Tract 5 – McFarland Lake	0.0	0.2	0.0	0.0
Subtotal: Non-federal Lands	125.7	3.0	9.1	>125.7 ⁽²⁾
Net Increase/(Decrease)	95.2	2.1	4.6	>125.7⁽²⁾

Notes:

¹ Wild rice beds within the Land Exchange Proposed Action boundaries are currently, and would continue to be, in MDNR-designated public waters.

² Excludes area of wild rice beds in Pike River.

5.3.2.3 Land Exchange Alternative B

Under the Land Exchange Alternative B, 4,752.6 acres of federal lands would be transferred from public to private ownership, and 4,926.3 acres of land from private to public ownership, for a net increase in 173.7 acres in the federal estate (see Figure 3.3-2).

5.3.2.3.1 Groundwater

The Land Exchange Alternative B would not directly result in a change in groundwater quantity or quality at the non-federal tracts. Evaluation of existing hydrogeologic data did not suggest the potential for groundwater contamination from human activity from any of the tracts. Therefore, there does not appear to be any substantive difference in the quality of groundwater resources between the federal and non-federal tracts.

5.3.2.3.2 Surface Water and Wild Rice

The Land Exchange Alternative B would not directly result in a change in surface water quantity or quality at the non-federal tracts. There would be a net increase to the federal estate of about 3.6 miles of public water streams, under Land Exchange Alternative B. There would also be a net increase of about 116.8 acres of public water lake area (including 2.6 miles of shoreline) and at least 125.7 acres of wild rice beds contained within the federal estate under the Land Exchange Alternative B.

No wild rice stands are known to occur on the smaller federal parcel, and suitable habitat is limited. The non-federal lands that contain wild rice beds would not be affected as a result of the Land Exchange Proposed Action or Land Exchange Alternative B, because no activities are proposed on these lands and the proposed mining activities would not affect these lands. As

noted in the FEIS, the Land Exchange Alternative B would result in a net increase of 125.7 acres of wild rice beds to the federal estate. FEIS Sections 5.3.2 and 5.3.4 clarify that, although the Land Exchange would result in an increase in wild rice stands within the federal estate boundaries, there would be no change to the existing public access to Tract 1 wild rice stands via the Pike River. Consequently, there would be no increase in wild rice harvest opportunities for the public.

Table 5.3.2-3 summarizes the federal and non-federal surface water resources and shows the net changes in these resources to the federal estate that would result from the Land Exchange Alternative B.

Table 5.3.2-3 Net Change in Surface Water and Wild Rice Beds to the Federal Estate under Land Exchange Alternative B

	Surface Water Resource			
	Public Water Lakes (acres)	Public Water Lakes (miles of shoreline)	Public Water Streams (miles)	Wild Rice Beds (acres) ¹
Lands Conveyed				
Federal Lands	8.9	0.2	4.5	0.0
Lands Acquired				
Tract 1	125.7	2.8	8.1	>125.7 ⁽²⁾
Net Increase/(Decrease)	116.8	2.6	3.6	>125.7⁽²⁾

Notes:

¹ Wild rice beds within the Land Exchange Alternative B boundaries are currently, and would continue to be, in MDNR-designated public waters.

² Excludes area of wild rice beds in Pike River.

5.3.2.4 Land Exchange No Action Alternative

Under the Land Exchange No Action Alternative, the Land Exchange Proposed Action would not take place and would result in no changes in existing water resources under federal ownership. The Superior National Forest would have an ongoing responsibility for managing water resources on the federal lands in accordance with the Forest Plan. The Land Exchange No Action Alternative would not change the USFS responsibility for managing water resources.

-Page Intentionally Left Blank-

5.3.3 Wetlands

This section describes the potential environmental consequences of the Land Exchange Proposed Action on wetland resources that occur on the federal and non-federal lands. In this section, effects on the federal and non-federal lands are discussed together, to facilitate calculation of net changes to wetland resources. Under the Land Exchange Proposed Action and alternatives, the Superior National Forest would retain its ongoing responsibility for managing wetland resources on Forest Service lands in accordance with the Forest Plan.

Overall, the Land Exchange Proposed Action would result in an increase to the federal estate of wetland acreage by up to 505.5 acres through the acquisition of up to 7,075.0 acres of non-federal lands in exchange for 6,495.4 acres of federal land, and thus would be in conformity with EO 11990 (see Table 5.3.3-1). The Land Exchange Proposed Action would result in a net increase to the federal estate of 376.2 acres of mapped floodplain area, but would result in a decrease of 1,602.2 acres of unmapped floodplain area, for a net decrease of 1,226.0 acres of overall floodplain area (see Table 5.3.3-1). There would be no decrease in the amount of mapped floodplain or increase in the flood damage potential associated with the Land Exchange Proposed Action. The effects on the ecological function of the floodplain wetlands would be mitigated through the Section 404 Permit and the proposed mitigation described in Section 5.2.3. The Land Exchange Proposed Action would also increase the wetlands within the federal estate. The Land Exchange Proposed Action would be in conformance with EO 11988 (USFS 2004d [FSH 5409.13 § 33.43c]). The Land Exchange Proposed Action would result in an increase of coniferous swamp, hardwood swamp, open water, shallow marsh, and shrub swamp wetland resources to the federal estate, but would result in a decrease of coniferous bog, open bog, and sedge/wet meadows wetland resources to the federal estate (see Table 5.3.3-2). In addition, the Land Exchange Proposed Action would result in an increase in waterway acreage and frontage to the federal estate (see Table 5.3.3-3).

Due to the reduced land area involved, Land Exchange Alternative B would result in a lesser degree of wetlands, floodplains, and other water resources exchanged to the federal estate as compared to the proposed Land Exchange Proposed Action. Overall, Land Exchange Alternative B would increase wetland areas to the federal estate by 69.9 acres (see Table 5.3.3-1) through the acquisition of up to 4,926.3 acres of the non-federal lands in exchange for 4,752.6 acres of federal land, and would thus be in conformity with EO 11990. The Land Exchange Alternative B would result in a net increase to the federal estate of 376.2 acres of mapped floodplain area, but would result in a decrease of 1,237.9 acres of unmapped floodplain area, for a net decrease of 861.7 acres of overall floodplain area (see Table 5.3.3-1). There would be no decrease in the amount of mapped floodplain or increase in the flood damage potential associated with the Land Exchange Alternative B. The effects on the ecological function of the floodplain wetlands would be mitigated through the Section 404 Permit and the proposed mitigation described in Section 4.2.3. The Land Exchange Alternative B would also increase the wetlands within the federal estate. The Land Exchange Alternative B would be in conformance with EO 11988 (USFS 2004d [FSH 5409.13 § 33.43c]). Land Exchange Alternative B would result in an increase of coniferous swamp, open water, shallow marsh, and shrub swamp wetland resources to the federal estate but would result in a decrease to coniferous bog, hardwood swamp, open bog, and sedge/wet meadows wetland resources to the federal estate (see Table 5.3.3-2). In addition, Land

Exchange Alternative B would result in an increase of waterway acreage and frontage to the federal estate (see Table 5.3.3-3).

Table 5.3.3-1 Net Increase or Decrease of Wetland and Floodplain Acres on the Federal Estate from the Land Exchange Proposed Action and Alternatives

Alternative	Increase (or Decrease) of Wetland and Floodplain Acres	
	Wetlands (Acres)	Floodplains ^{1,2} (Acres)
Land Exchange Proposed Action	505.5	(1,226.0)
Land Exchange Alternative B	69.9	(861.7)

Notes:

¹ The federal floodplain area is a 500-year (0.2%) probability floodplain.

² Includes an increase of 376.2 acres of mapped floodplains to the federal estate.

Table 5.3.3-2 Net Increase or Decrease of Wetland Resource Types on the Federal Estate from the Land Exchange Proposed Action and Alternatives

Alternative	Increase (or Decrease) of Wetland Resource Types (Acres)								
	Coniferous Bog	Coniferous Swamp ¹	Deep Marsh	Hardwood Swamp ²	Open Bog	Open Water (includes shallow, open water, and lakes)	Sedge/Wet Meadow	Shallow Marsh ³ (Shrub swamp (includes alder thicket and shrub-carr))	
Land Exchange Proposed Action	(1,961.4)	1,954.6	0.0	36.9	(202.4)	151.7	(35.7)	20.5	541.3
Land Exchange Alternative B	(1,677.0)	1,477.8	0.0	(5.7)	(172.9)	168.0	(34.9)	3.2	311.4

Notes:

¹ Coniferous bogs on the non-federal lands were grouped with coniferous swamps during field data collection.

² Hardwood swamps on the non-federal lands may contain coniferous tree species.

³ Shallow marsh areas on the non-federal lands may contain deep marshes.

Table 5.3.3-3 Net Increase or Decrease of Frontage of Waterways on the Federal Estate from the Land Exchange Proposed Action and Alternatives

Alternative	Increase (or Decrease) of Frontage of Waterways					
	Lake		River/Stream/Creek			
	Acres	Frontage (ft)	Length of Lake Frontage/Acre	Miles	Frontage (linear ft)	Length of River Frontage/Acre
Land Exchange Proposed Action	99.1	12,864.0	129.8	3.8	27,456.0	34.0
Land Exchange Alternative B	120.7	15,224.0	126.1	2.8	16,896.0	3.5

Source: Data from Section 4.3.3.

Based on a qualitative assessment, the Land Exchange Proposed Action and Land Exchange Alternative B would appear to result in an increase to the federal estate of wetlands rated as high for vegetation diversity/integrity, wetland water quality, fish habitat, and amphibian habitat.

Land Exchange Alternative B would also appear to result in an increase to the federal estate of wetlands rated as high for hydrology and wildlife habitat. The Land Exchange Proposed Action would result in an increase to the federal estate of moderate and low rated wetlands for amphibian habitat, as where Land Exchange Alternative B would also result in an increase to the federal estate of wetlands rated low for amphibian habitat. The Land Exchange Proposed Action would have similarly rated hydrology, flood attenuation, downstream water quality, wildlife habitat, and aesthetics/education/cultural functions. Land Exchange Alternative B would result in a decrease to the federal estate of wetlands rated high and moderate for flood attenuation and downstream water quality and would not result in a change to aesthetics/education/cultural functions.

5.3.3.1 Methodology and Evaluation Criteria

The potential effect that the Land Exchange Proposed Action and alternatives would have on wetland resources was evaluated using two types of criteria: 1) criteria assessing conformity to EOs 11990 and 11988, which requires a wetland acre-for-acre analysis and a floodplain acre-for-acre analysis of the federal estate; and 2) criteria used in an analysis of wetlands and floodplain habitat, as well as other water resource indicators.

As previously discussed, to satisfy the requirements of EOs 11990 and 11988, the USFS policy is to use the following three conditions (USFS 2004d [FSH 5409.13 § 33.43c]): 1) the value of the wetlands or floodplains for properties received and conveyed is equal (balancing test) and the land exchange is in the public interest, 2) reservations or restrictions are retained on the unbalanced portion of the wetlands and floodplains on the federal lands when the land exchange is in the public interest but does not meet the balancing test, and 3) the federal property is removed from the exchange proposal when the conditions described in the preceding paragraphs 1 or 2 cannot be met.

In addition to evaluating wetlands in accordance with the two EOs, analysis of the Land Exchange included information on wetland community types as well as ecological floodplains.

To evaluate conformity to the EOs, the following evaluation criteria were used:

- Comparative difference in acres of wetland between the federal and non-federal parcels; and
- Comparative difference in acres of floodplain between the federal and non-federal parcels.

Other wetland resources indicators that were used are the following:

- Comparative difference in acres of wetland types between the federal and non-federal parcels;
- A MnRAM assessment of wetland function and value;
- Change in flood damage potential on the parcels and to the surrounding parcels;
- A MnRAM assessment of floodplain assets; and
- Comparative difference of length of streams, rivers, and lake frontage between the federal and non-federal parcels.

The spatial area of analysis for wetland resource effects from the Land Exchange Proposed Action and alternatives included the federal and non-federal tracts proposed for the exchange,

while the temporal area of analysis assessed was the point in time at which the change in ownership would occur.

The analysis of the wetland resources affected by the Land Exchange Proposed Action and alternatives was guided by evaluation criteria that were developed by the USFS and other Co-lead Agencies, which included a comparison of wetland resource acreages, wetland resources types, wetland function and values, floodplain acreages, and other water resources acreages. GIS data and field observations were used and then compared over an area of analysis that included the federal and non-federal lands.

5.3.3.1.1 Wetlands

The federal lands contain 4,164.4 acres of wetlands (see Table 5.3.3-4). By comparison, the five non-federal land tracts contain 4,669.9 acres of wetlands. The Land Exchange Proposed Action would result in a net increase of up to 505.5 acres of wetlands to the federal estate if all five tracts are exchanged (see Table 5.3.3-4). The Land Exchange Proposed Action would increase wetland acreage to the federal estate by up to 505.5 acres through the acquisition of up to 7,075.0 acres of non-federal lands in exchange for 6,495.4 acres of federal land, and thus would be in conformity with EO 11990.

Table 5.3.3-4 Wetland and Floodplain Acres for the Land Exchange Proposed Action

Parcel	Acres of Wetlands	Acres of Floodplains
Lands Conveyed		
Federal Lands	4,164.4	1,889.4 ⁽¹⁾
Lands Acquired		
Tract 1	2,930.8	551.2
Tract 2	209.3	0.0
	73.6	0.0
	90.4	0.0
Tract 3	706.2	0.0
	233.2	32.8
	362.8	79.4
Tract 4	63.6	0.0
Tract 5	0.0	0.0
Subtotal: Non-federal lands	4,669.9	633.4
Net Change		
Net Increase/(Decrease)	505.5	(1,226.0) ⁽²⁾

Notes:

¹ The federal floodplain area is a 500-year (0.2%) probability floodplain.

² Includes an increase of 376.2 acres of mapped floodplains to the federal estate.

As part of the increase in total wetland acreage, the Land Exchange Proposed Action would result in a net increase to the federal estate of the following wetland resource types (see Table 5.3.3-5): coniferous swamp (1,954.6 acres), hardwood swamp (36.9 acres), open water (151.7 acres), shallow marsh (20.5 acres), and shrub swamp (541.3 acres). However, the Land Exchange Proposed Action would result in a net decrease to the federal estate of the following wetland resource types: coniferous bog (1,961.4 acres), open bog (202.4 acres), and sedge/wet meadow (35.7 acres).

Table 5.3.3-5 Wetland Resource Types for the Land Exchange Proposed Action

Parcel	Acres of Wetland Resource Types									
	Coniferous Bog	Coniferous Swamp ¹	Deep Marsh	Hardwood Swamp ²	Open Bog	Open Water (includes shallow, open water, and lakes)	Sedge/Wet Meadow	Shallow Marsh ³		
Lands Conveyed										
Federal Lands	1,961.4	1,287.8	0.0	21.1	209.5	30.8	35.7	97.0	521.1	
Lands Acquired										
Tract 1	0.0	1,953.9	0.0	8.0	2.1	176.6	0.0	84.1	706.1	
Tract 2	Lake County North	0.0	135.0	0.0	34.7	1.8	0.2	0.0	2.5	35.1
	Lake County South	0.0	32.4	0.0	9.9	0.0	2.5	0.0	12.3	16.5
Tract 3	Wolf Lands 1	0.0	75.4	0.0	0.0	3.0	0.0	0.0	0.0	12.0
	Wolf Lands 2	0.0	627.4	0.0	5.0	0.0	0.4	0.0	0.4	73.0
	Wolf Lands 3	0.0	82.6	0.0	0.0	0.0	0.0	5.2	145.4	
	Wolf Lands 4	0.0	320.3	0.0	0.0	0.2	0.0	0.0	0.0	42.3
Tract 4	0.0	15.4	0.0	0.4	0.0	2.8	0.0	13.0	32.0	
Tract 5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Subtotal: Non-federal lands	0.0	3,242.4	0.0	58.0	7.1	182.5	0.0	117.5	1,062.4	
Net Change										
Net Increase/(Decrease)	(1,961.4)	1,954.6	0.0	36.9	(202.4)	151.7	(35.7)	20.5	541.3	

Notes:

¹ Coniferous bogs on the non-federal lands were grouped with coniferous swamps during field data collection.

² Hardwood swamps on the non-federal lands may contain coniferous tree species.

³ Shallow marsh areas on the non-federal lands may contain deep marshes.

5.3.3.1.2 Wetland Functional Assessment

Based on a qualitative assessment, the Land Exchange Proposed Action would appear to result in an increase to the federal estate of the following high rated wetland functions: vegetation diversity/integrity, wetland water quality, fish habitat, and amphibian habitat. The Land Exchange Proposed Action would result in an increase to the federal estate of moderate- and low-rated wetlands for amphibian habitat. The Land Exchange Proposed Action would have similarly rated hydrology, flood attenuation, downstream water quality, wildlife habitat, and aesthetics/education/cultural functions. It is recognized that the federal land contains a large contiguous wetland complex with an intact upland. Such a complex offers additional value beyond simply the accounting of the number of acres. This is reflected in the MnRAM analysis as the setting is considered. However, it should also be noted that although there are a number of separate non-federal lands proposed in the exchange, they are also part of larger ecological complexes that are intact and offer similar benefits. Conversion of these lands into federal ownership and management will provide additional protection of the values associated with larger wetland complexes.

5.3.3.1.3 Floodplains

There are no mapped floodplains within the federal lands as described in Section 4.3.3. The Land Exchange Proposed Action would result in a net increase to the federal estate of 376.2 acres of mapped floodplain area, but would result in a decrease of 1,602.2 acres of unmapped floodplain area, for a net decrease of 1,226.0 acres of overall floodplain area (see Table 5.3.3-4). There would be no decrease in the amount of mapped floodplain or increase in the flood damage potential associated with the Land Exchange Proposed Action. The effects on the ecological function of the floodplain wetlands would be mitigated through the Section 404 Permit and the proposed mitigation described in Section 4.2.3. The Land Exchange Proposed Action would also increase the wetlands within the federal estate. The Land Exchange Proposed Action would be in conformance with EO 11988 (USFS 2004d [FSH 5409.13 § 33.43c]).

5.3.3.1.4 Frontage of Waterways

The Land Exchange Proposed Action would result in a net increase of other water resources to the federal estate (see Table 5.3.3-6). A net increase of 99.1 acres of lake and 3.8 miles of rivers would be added to the federal estate from the Land Exchange Proposed Action. These increases would result in additional frontage of lakes and rivers to the federal estate.

Table 5.3.3-6 Frontage of Waterways for the Land Exchange Proposed Action

Parcel	Acres	Lake		Rivers/Creeks/Streams		
		Frontage (ft)	Length of Lake Frontage/Acre	Miles	Frontage (linear ft)	Length of River Frontage/Acre
Lands Conveyed						
Federal Lands	30.5	4,550.0	0.7	5.3	55,968.0	8.6
Lands Acquired						
Tract 1	129.6	16,424.0	3.5	8.1	72,864.0	15.3
Tract 2	0.0	0.0	0.0	0.0	0.0	0.0
Wolf Lands 1	0.0	0.0	0.0	0.0	0.0	0.0
Tract 3	Wolf Lands 2	0.0	0.0	0.0	0.0	0.0
Wolf Lands 3	0.0	0.0	0.0	0.1	1,056.0	3.8
Wolf Lands 4	0.0	0.0	0.0	0.9	9,504.0	23.5
Tract 4	0.0	0.0	0.0	0.0	0.0	0.0
Tract 5	0.0	990.0	32.1	0.0	0.0	0.0
Subtotal: Non-federal lands	129.6	17,414.0	35.6	9.1	83,424.0	42.6
Net Change						
Net Increase/(Decrease)	99.1	12,864.0	34.9	3.8	27,456.0	34.0

Source: Data from Section 4.3.3.

5.3.3.2 Land Exchange Alternative B

5.3.3.2.1 Wetlands

The smaller federal parcel contains 2,860.9 acres of wetlands (see Table 5.3.3-7). By comparison, the non-federal lands contain 2,930.8 acres of wetlands. The Land Exchange Alternative B would result in a net increase of 69.9 acres of wetlands to the federal estate. The Land Exchange Alternative B would increase wetland areas to the federal estate by 69.9 acres through the acquisition of up to 4,926.3 acres of the non-federal lands in exchange for 4,752.6 acres of federal land, and would thus be in conformity with EO 11990.

Table 5.3.3-7 Wetland and Floodplain Acres for Land Exchange Alternative B

	Acres of Wetlands	Acres of Floodplains
Lands Conveyed		
Smaller Federal Parcel	2,860.9	1,412.9 ¹
Lands Acquired		
Tract 1	2,930.8	551.2
Net Change		
Net Increase/(Decrease)	69.9	(861.7) ²

Notes:

¹ The federal floodplain area is a 500-year (0.2%) probability floodplain.

² Includes an increase of 376.2 acres of mapped floodplains to the federal estate.

As part of the increase in wetland acreage, Land Exchange Alternative B would result in a net increase to the federal estate of the following wetland resource types (see Table 5.3.3-8): coniferous swamp (1,477.8 acres), open water (168.0 acres), shallow marsh (3.2), and shrub swamp (311.4 acres). However, the Land Exchange Alternative B would result in a net decrease to the federal estate of the following wetland resource types: coniferous bog (1,677.0 acres), hardwood swamp (5.7 acres), open bog (172.9 acres), and sedge/wet meadow (34.9 acres).

Table 5.3.3-8 Wetland Resource Types for Land Exchange Alternative B

Parcel	Acres of Wetland Resource Types								
	Coniferous Bog	Coniferous Swamp ¹	Deep Marsh	Hardwood Swamp ²	Open Bog	Open Water (includes shallow, open water, and lakes)	Sedge/Wet Meadow	Shallow Marsh ³	Shrub Swamp (includes alder thicket and shrub- carr)
Lands Conveyed									
Smaller Federal Parcel	1,677.0	476.1	0.0	13.7	175.0	8.6	34.9	80.9	394.7
Lands Acquired									
Tract 1	0.0	1,953.9	0.0	8.0	2.1	176.6	0.0	84.1	706.1
Net Change									
Net Increase/(Decrease)	(1,677.0)	1,477.8	0.0	(5.7)	(172.9)	168.0	(34.9)	3.2	311.4

Notes:

¹ Coniferous bogs on the non-federal lands were grouped with coniferous swamps during field data collection.

² Hardwood swamps on the non-federal lands may contain coniferous tree species.

³ Shallow marsh areas on the non-federal lands may contain deep marshes.

5.3.3.2.2 Wetland Functional Assessment

The Land Exchange Alternative B would result in an increase to the federal estate of wetlands rated as high for vegetation diversity/integrity, hydrology, wetland water quality, wildlife habitat, fish habitat, and amphibian habitat. There would be a decrease to the federal estate of wetlands rated high and moderate for flood attenuation and downstream water quality. The Land Exchange Alternative B would also result in an increase to the federal estate of wetlands rated low for amphibian habitat. The Land Exchange Alternative B would not result in a change to aesthetics/education/cultural functions to the federal estate.

5.3.3.2.3 Floodplains

There are no mapped floodplains within the federal lands as described in Section 4.3.3. The Land Exchange Alternative B would result in a net increase to the federal estate of 376.2 acres of mapped floodplain area and 1,237.9 acres of unmapped floodplain area, for a net decrease of 861.7 acres of overall floodplain area (see Table 5.3.3-7). There would be no decrease in the amount of mapped floodplain or increase in the flood damage potential associated with the Land Exchange Alternative B. The effects on the ecological function of the floodplain wetlands would be mitigated through the Section 404 Permit and the proposed mitigation described in Section 4.2.3. The Land Exchange Alternative B would also increase the wetlands within the federal estate. The Land Exchange Alternative B would be in conformance with EO 11988 (USFS 2004d [FSH 5409.13 § 33.43c]).

5.3.3.2.4 Frontage of Waterways

The Land Exchange Alternative B would result in a net increase of other water resources to the federal estate (see Table 5.3.3-9). A net increase of 120.7 acres of lake and 2.8 miles of rivers would be added to the federal estate from the Land Exchange Alternative B. These increases would result in additional frontage of lakes and rivers to the federal estate.

Table 5.3.3-9 Frontage of Waterways for Land Exchange Alternative B

Parcel	Acres	Lake		Rivers/Creeks/Streams		
		Frontage (ft)	Length of Lake Frontage/Acre	Miles	Frontage (linear ft)	Length of River Frontage/Acre
Lands Conveyed						
Smaller Federal Parcel	8.9	1,200.0	0.3	5.3	55,968.0	11.8
Lands Acquired						
Tract 1	129.6	16,424.0	3.5	8.1	72,864.0	15.3
Net Change						
Net Increase/(Decrease)	120.7	15,224.0	3.2	2.8	16,896.0	3.5

Source: Data from Section 4.3.3.

5.3.3.3 Land Exchange No Action Alternative

Under the Land Exchange No Action Alternative, the Superior National Forest would have an ongoing responsibility for managing wetland resources, floodplains, and surface waters on the federal lands in accordance with the Forest Plan. The Land Exchange No Action Alternative would not change USFS's responsibility for managing wetland resources, floodplains, and surface waters and would result in no further effects on these resources.

5.3.4 Vegetation

This section provides an evaluation of the effects of the Land Exchange Proposed Action on vegetation, including comparisons of MDNR GAP land cover types, native plant community types, MBS Sites of Biodiversity Significance, MIH types, age classes, threatened and endangered plant species, and biodiversity between the federal and non-federal lands. Table 5.3.4-1 provides a summary of these data on a net increase or decrease basis to the federal estate.

When comparing the total acres of the federal and non-federal lands, the federal estate would have an increase of 579.6 acres of MDNR GAP land cover types (see Table 5.3.4-1) as a result of the Land Exchange Proposed Action. The shrublands (1,199.4 acres) would increase the most and the upland conifer forests (919.5 acres) would decrease the most (see Table 5.3.4-2). There would be an acreage increase of upland forest (MIH 1) with lesser amounts of lowland black spruce-tamarack forest (MIH 9) and aquatic habitat (MIH 14), but a decrease of upland conifer forest (MIH 5) to the federal estate (see Table 5.3.4-1). There would be an increase to the federal estate of immature forest stands with lesser amounts of young stands, but a decrease in mature forest stands.

There would be a decrease to the federal estate of up to approximately 6,025.8 acres of MBS Sites of High Biodiversity Significance and an increase of up to 767.9 acres of MBS Sites of Moderate Biodiversity Significance under the Land Exchange Proposed Action (see Table 5.3.4-1). There would be a decrease to the federal estate of three native plant communities that are “imperiled,” “imperiled-vulnerable,” or “vulnerable,” as well as others that are ranked as “apparently secure” or “widespread and secure,” in exchange for one native plant community that is ranked as “vulnerable” and two that are ranked as “apparently secure.” There would be a decrease to the federal estate of up to 2,016.6 acres in the Jack Pine-Black Spruce landscape ecosystem, and an increase of up to 994.7 acres in the Lowland Conifer landscape ecosystem and 558.7 acres in the Mesic Red and White Pine landscape ecosystem. Additionally, the USFS would increase representation in the Dry-Mesic Red and White Pine, Mesic Birch-Aspen-Spruce-Fir, Lowland Hardwood, and Sugar Maple landscape ecosystems. Overall, there would be an increase to the federal estate of 625.2 acres of landscape ecosystems as a result of the Land Exchange Proposed Action.

There would be a decrease to the federal estate of 12 populations of 10 state-listed ETSC plant species on the federal lands in exchange for three populations of three known state-listed ETSC plant species on the non-federal lands. Though the 10 state-listed plant species on the federal lands are not known to occur on the non-federal lands, the Land Exchange Proposed Action would result in an increase to the federal estate of most habitats important to them. Drawing from the MIH exchange, RFSS plants associated with upland forest (MIH 1), lowland black spruce-tamarack forest (MIH 9), and aquatic habitat (MIH 14) could potentially exist on or spread to the habitats on the non-federal parcels. There would also be a gain of Rove Formation cliff microhabitats to the federal estate, which are important for a variety of RFSS plants in the Superior National Forest.

Rulemaking was conducted with the intent to update the list of ETSC species (*Minnesota Rules*, parts 6134.0100 to 6134.0400), with new listings becoming effective on August 19, 2013 (MDNR 2013h). This FEIS considers any new listings, or changes in the previous listings, associated with the updated list. The FEIS also considers any federal listing changes.

A Biological Evaluation has been prepared that contains further information about RFSS. The Biological Evaluation is included in Appendix D. The organization of the methodologies and discussion in the Biological Evaluation may be different from the FEIS. The document also contains determinations of effect for the species discussed.

Table 5.3.4-1 Vegetation and Cover Type Increase or Decrease to the Federal Estate Due to Land Exchange Proposed Action and Alternatives

Category		Net Increase/(Decrease)		
		Land Exchange		
		Proposed Action	Land Exchange Alternative B	Land Exchange No Action Alternative
Habitat Types (acres)	MDNR GAP Land Cover Types	579.6	173.6	0.0
	MIH 1 (Upland Forest)	1,364.5	1,411.8	0.0
	MIH 5 (Upland Conifer Forest)	(1,172.5)	(1,084.6)	0.0
	MIH 9 (Lowland Black Spruce-tamarack Forest)	248.3	(261.1)	0.0
	MIH 14 (Aquatic Habitat)	226.7	206.2	0.0
	Lowland Shrub	(160.1)	(272.1)	0.0
	Lowland Emergent	200.2	249.6	0.0
	Upland Grass	43.3	0.0	0.0
	Young Forest Stands	507.1	262.7	0.0
	Immature Forest Stands	2,000.5	1,933.9	0.0
MBS Sites (acres)	Mature Forest Stands	(2,029.6)	(2,114.5)	0.0
	High Biodiversity Sites	(6,025.8)	(4,573.1)	0.0
	Moderate Biodiversity Sites	767.9	(0.3)	0.0
	Imperiled (S2)	(1.0)	0.0	0.0
Native Plant Communities	Imperiled/Vulnerable (S2-3)	(1.0)	(1.0)	0.0
	Vulnerable (S3)	(1) and +1 other	(1.0)	0.0
	Apparently Secure (S4)	(6) and +2 others	(2.0)	0.0
	Widespread and Secure (S5)	(6.0)	(4.0)	0.0
Landscape Ecosystems (acres)	Dry-Mesic Red and White Pine	683.0	589.2	0.0
	Jack Pine-black Spruce	(2,016.6)	(1,411.6)	0.0
	Lowland Conifer	994.7	486.2	0.0
	Lowland Hardwood	66.5	0.0	0.0
	Mesic Birch-aspen-spruce-fir	302.2	0.9	0.0
	Mesic Red and White Pine	558.7	528.0	0.0
	Sugar Maple	36.7	0.0	0.0
ETSC Species (number of species)	(10) species +3 different species		(10) species +1 different species	0.0
	State-listed Plant Species			
Management Area (acres)	General Forest	5,714.1	4,264.0	0.0
	General Forest – Longer Rotation	(5,658.0)	(4,397.3)	0.0
	cRNA	306.9	306.9	0.0
	Riparian Emphasis Area	220.9	0.0	0.0

5.3.4.1 Methodology and Evaluation Criteria

The vegetation assessment area for the Land Exchange Proposed Action would involve 6,495.4 acres of federal lands transferred from public to private ownership, and up to 7,075.0 acres of land transferred from private to public ownership. The spatial and temporal area of analysis for vegetation as part of the Land Exchange Proposed Action included direct and indirect effects resulting from the change in ownership of the federal and non-federal lands, including the extent of landscape ecosystems as defined in the Forest Plan or the extent of similar landscape ecosystems on the abutting forest lands.

An evaluation was conducted to determine the potential effect that the Land Exchange Proposed Action would have on the following vegetation resources:

- The quality and quantity of forest resources/lands (change in forest types and age classes);
- Change in state-listed ETSC plant species and RFSS plants (individuals, habitat, and/or populations);
- Change in biodiversity or overall vegetation and habitat; and
- The introduction and spread of invasive non-native species.

The analysis of the vegetation resources affected by the Land Exchange Proposed Action was guided by evaluation criteria that were developed by the USFS and other Co-lead Agencies, which included a comparison of the MDNR GAP land cover types, native plant communities, MBS Sites of Biodiversity Significance, MIH types (MIH 1, 5, 9, and 14, as well as lowland shrublands, lowland emergent wetlands, and upland grass), age classes (young, immature, and mature), large mature forest patches, landscape ecosystems, management areas, threatened and endangered plant species, RFSS plants, and invasive non-native plant species. GIS data for these categories were gathered to the extent possible, and then compared over an area of analysis that included the federal and non-federal lands, and also the surrounding landscape ecosystems of the Superior National Forest or ecological subsections. MIH types and age classes have also been compared within the context of landscape ecosystems to reveal how many acres of each MIH and age class would be increased or decreased on the federal estate by the Land Exchange Proposed Action within each landscape ecosystem. MIH type and age class data for the non-federal lands were interpreted from field survey maps, aerial maps, surrounding federal MIH data, topographic maps, and USFS review. These were then compared to the federal lands MIH data to determine MIH type and age class increases or decreases of acreage to the federal estate. Additionally, all of the data types mentioned have been compared to summarize the vegetative biodiversity of the federal and non-federal lands.

5.3.4.2 Land Exchange Proposed Action

5.3.4.2.1 Cover Types

Cover types consist of several categories of classification, including MDNR GAP land cover types, USFS management areas, USFS ELTs, and USFS MIH types.

Habitat Types

The Land Exchange Proposed Action would result in an increase to the federal estate of up to 579.6 acres of MDNR GAP land cover designations, with the greatest increase in shrubland

acreage of 1,199.4 acres and the greatest decrease in upland conifer forest of 919.5 acres (see Table 5.3.4-2). The decrease of upland conifer forest is contrary to a goal of the 2004 Forest Plan. The Forest Plan calls for an increase in the acreage of red, white, and jack pine habitats (and a decrease in the acreage of aspen vegetation communities). In addition, the Land Exchange Proposed Action would support other Forest Plan goals to maintain acreage of lowland deciduous habitats and non-forested wetlands. The Land Exchange Proposed Action would result in a small increase to the federal estate of lowland deciduous forests, an increase in aquatic habitats, and a large increase of shrublands.

Table 5.3.4-2 Net Increase or Decrease to the Federal Estate of MDNR GAP Land Cover Types under the Land Exchange Proposed Action

Cover Types	Federal Land Acres	Non-federal Land Acres	Net Increase/ (Decrease) Acres
Shrubland	645.6	1,845.0	1,199.4
Aquatic environments	60.1	266.6	206.5
Upland deciduous forest	1,091.8	1,232.9	141.1
Upland conifer-deciduous mixed forest	20.9	50.4	29.5
Cropland/grassland	6.2	31.7	25.5
Lowland deciduous forest	9.5	28.6	19.1
Lowland coniferous forest	2,978.6	2,920.5	(58.1)
Disturbed	63.8	0.0	(63.8)
Upland coniferous forest	1,618.9	699.4	(919.5)
Total ¹	6,495.4	7,075.0	579.6

Source: MDNR 2006b.

Note:

¹ Total acres may be more or less than presented due to rounding.

Culturally Important Plants

The Land Exchange Proposed Action would result in additional wild rice beds on the federal estate by the acquisition of Tract 1. Tract 1 contains Little Rice Lake, which supports a continuous population of wild rice. Wild rice also grows along the Pike River south of Little Rice Lake and in isolated populations on Hay Lake. Section 4.3.4.2.5 provides further discussion of wild rice on Tract 1. Wild rice does not currently grow within the proposed federal land boundaries. Though the Land Exchange would result in an increase in wild rice beds within the federal estate boundaries, there is existing public access to Tract 1 wild rice beds via the Pike River. Consequently, there would be no change in wild rice harvest opportunities for the public. A carry-down boat launching access point is located on Tract 1, which may provide private access for wild rice harvesting on the Tract 1 lands.

Natural resources culturally important to the Bands are discussed in Section 4.2.9.3.3.

Minnesota Biological Survey

The Land Exchange Proposed Action would result in a decrease to the federal estate of 6,142.7 acres of MBS Sites of High Biodiversity Significance in the Laurentian Uplands subsection, and an increase of 116.9 acres of MBS Sites of High Biodiversity Significance in the North Shore Highlands subsection. Furthermore, the Land Exchange Proposed Action would result in an

increase to the federal estate of 767.6 acres of MBS Sites of Moderate Biodiversity Significance in the Laurentian Uplands subsection.

Native plant community rankings are largely unavailable for the non-federal lands, with the exception of Lake County South, which has one site ranked as “vulnerable” and others ranked as “apparently secure.” Section 4.3.4.2.6 provides further discussion of native plant community types on the Lake County South parcel. The Land Exchange Proposed Action would result in a decrease to the federal estate of three native plant communities on the federal lands that are ranked as “imperiled” to “vulnerable” in the state. A native plant community increase or decrease comparison cannot be accurately made since rankings are unavailable for much of the non-federal lands.

Management Areas

In conjunction with landscape ecosystem objectives, the USFS has developed desired future conditions and objectives, based on management areas, which describe what is desired socially and economically (USFS 2004b). The majority of the non-federal lands (86 percent) would be allocated to the General Forest Management Area upon completion of the Land Exchange Proposed Action. This management area provides a wide variety of goods, uses, and services, including wood products, scenic quality, recreation opportunities, and habitat types (USFS 2004b). The remaining non-federal lands would be allocated to the General Forest – Longer Rotation Management Area (7 percent), Potential/cRNA (4 percent), and Riparian Areas Management Area (3 percent). Section 5.3.1 provides a discussion of management area allocations on the non-federal lands for the Land Exchange Proposed Action.

Through the acquisition of Tract 1, the Land Exchange Proposed Action would result in a gain of a large contiguous block of land and lakeshore/river frontage. The majority of this tract (94 percent) would be allocated to the General Forest Management Area, with the balance allocated as a cRNA (6 percent). Two cRNA lands abut Tract 1 (USFS 2011b) and, upon completion of the Land Exchange Proposed Action, these two cRNA lands would be extended onto the parcel. The Pike Mountain cRNA is located at the southwestern corner of Tract 1. Approximately 135 acres of Tract 1 are proposed to be added to the Pike Mountain cRNA because it is an extension of the northern hardwood uplands with a high sugar maple component. The Loka Lake cRNA is located at the northeastern corner of Tract 1. Approximately 172 acres of the parcel are proposed to be added to the Loka Lake cRNA because it is an extension of the high-quality lowland black spruce and tamarack swamp.

The Land Exchange Proposed Action would result in Tract 2 being allocated as Riparian Areas (83 percent) and General Forest – Longer Rotation Management Area (17 percent) (USFS 2011b). The Riparian Emphasis Area Management Area provides protection to diverse age classes, but generally for older-growth forest stands along sensitive riparian areas.

The majority of Tract 3 would be allocated to the General Forest Management Area (92 percent), with the remaining 8 percent allocated to the General Forest – Longer Rotation Management Area (USFS 2011b).

All of Tracts 4 and 5 would be allocated to the General Forest – Longer Rotation Management Area (USFS 2011b). Obtaining Tract 5 would result in a gain of lakeshore property.

Overall, there would be a large increase to the federal estate in the General Forest Management Area (5,714.1 acres) and smaller increases in the cRNA (306.9 acres) and Riparian Areas (220.9

acres) Management Areas as a result of the Land Exchange Proposed Action (see Table 5.3.4-3). There would be a decrease to the federal estate of 5,662.3 acres of the General Forest – Longer Rotation Management Area. The lands to be acquired as part of the Land Exchange Proposed Action would be managed in accordance with Forest Plan standards and guidelines. Section 5.3.1 describes the management areas in detail.

Table 5.3.4-3 Net Increase or Decrease to the Federal Estate of Management Areas under the Land Exchange Proposed Action

Category	Federal Lands		Non-federal Lands		Net Increase/ (Decrease)
	Acres	%	Acres	%	
General Forest	355.3	5	6,069.4	86	5,714.1
General Forest – Longer Rotation	6,140.2	95	477.8	7	(5,662.3)
Potential/cRNAs	0.0	0	306.9	4	306.9
Riparian Areas	0.0	0	220.9	3	220.9

Source: USFS 2011j.

Ecological Land Types

The Land Exchange Proposed Action would result in an increase to the federal estate of seven ELTs, including ELT 3, 4, 10, 11, 14, 17, and 18. Five of these ELTs are upland soils and two are lowland soils. The USFS would not lose representation of any ELTs currently on the federal lands, based on available data.

Management Indicator Habitats

The Land Exchange Proposed Action would result in an increase to the federal estate of upland forest (MIH 1; 1,364.5 acres), lowland black spruce-tamarack forest (MIH 9; 248.3 acres), and aquatic habitat (MIH 14; 226.7 acres), and a decrease of upland conifer forest (MIH 5; 1,172.5 acres) (see Table 5.3.4-4). The Land Exchange Proposed Action would also result in a decrease to the federal estate of lowland shrub habitat (160.1 acres), but an increase in lowland emergent (200.2 acres) and upland grass (43.3 acres) habitat types. While not considered MIH types, these are important habitats for several wildlife species. The fact that aquatic habitat (MIH 14) is not mapped on the federal lands results in an apparent increase to the federal estate in these categories, even though this habitat type does occur on the federal lands.

The Land Exchange Proposed Action would result in an increase to the federal estate of 2,507.6 acres of young and immature forest stands. However, it would result in a decrease to the federal estate of 2,029.6 acres of mature forest types. The Land Exchange Proposed Action would not result in a change to the federal estate of large patches (stands over 300 acres) of mature upland forests (MIH 13), as none exist on the federal lands (USFS 2012c) and the patches of mature forest on the non-federal lands are not part of the USFS Patch layer.

Table 5.3.4-4 Net Increase or Decrease to the Federal Estate of MIH Types and Age Classes under the Land Exchange Proposed Action

Category	Federal Land Acres ²	Non-federal Land Acres ^{1,2}	Net Increase/ (Decrease) Acres
MIH Types			
MIH 1 (Upland Forest)	1,330.0	2,694.5	1,364.5
MIH 5 (Upland Conifer Forest)	1,252.4	79.9	(1,172.5)
MIH 9 (Lowland Black Spruce-tamarack Forest)	3,060.2	3,308.5	248.3
MIH 14 (Aquatic Habitat)	0.0	226.7	226.7
Lowland Shrub	492.3	332.2	(160.1)
Lowland Emergent	185.5	385.7	200.2
Upland Grass	0.0	43.3	43.3
Age Classes			
Young	271.1	778.2	507.1
Immature	1,539.2	3,539.7	2,000.5
Mature	3,854.2	1,824.6	(2,029.6)

Source: USFS 2010b.

Notes:

¹ According to non-federal lands cover type table (see Table 4.3.4-3).

² Total acres may be more or less than presented due to rounding.

Landscape Ecosystems

The Land Exchange Proposed Action would result in a decrease to the federal estate of 2,016.6 acres of the Jack Pine-Black Spruce landscape ecosystem (0.65 percent decrease), but there would be an increase of 994.7 acres in the Lowland Conifer landscape ecosystem (0.08 percent increase) and 558.7 acres of the Mesic Red and White Pine landscape ecosystem (0.73 percent increase). The Superior National Forest, as part of the Land Exchange Proposed Action, would have increased representation in the Dry-Mesic Red and White Pine landscape ecosystem (682.9 acres; 0.11 percent increase), Mesic Birch-Aspen-Spruce-Fir landscape ecosystem (302.2 acres; 0.04 percent increase), Lowland Hardwood landscape ecosystem (66.5 acres; 0.01 percent increase), and the Sugar Maple landscape ecosystem (36.7 acres; 0.04 percent increase), and there would be an overall increase to the federal estate of 625.1 acres.

Within the Superior National Forest, the USFS tracks acreage of MIH types and age classes within each landscape ecosystem to better manage them within the broader ecological context. As a result of the Land Exchange Proposed Action, there would be an increase to the federal estate in acreage of MIH types and age classes within some landscape ecosystems and a decrease in others (see Table 5.3.4-5). The greatest percentage increase to the federal estate in MIH acreage within a landscape ecosystem is lowland black spruce-tamarack forest (MIH 9) in the Mesic Birch-Aspen-Spruce-Fir landscape ecosystem, while the greatest decrease is upland conifer forest (MIH 5) in the Jack Pine-Black Spruce landscape ecosystem. The greatest percentage increase to the federal estate in age class acreage within a landscape ecosystem is the immature age class in the Lowland Conifer landscape ecosystem, while the greatest decrease is the immature and mature age classes in the Jack Pine-Black Spruce landscape ecosystem. Overall, the Lowland Conifer landscape ecosystem would have the highest acreage increase to the federal estate in MIH types and age classes, while the Jack Pine-Black Spruce landscape ecosystem would have the highest acreage decrease in MIH types and age classes.

Table 5.3.4-5 Net Increase or Decrease to the Federal Estate of MIH Types and Age Classes within Landscape Ecosystems in the Superior National Forest under the Land Exchange Proposed Action

Landscape Ecosystem Name	Dry-Mesic Red and White Pine	Jack Pine-Black Spruce	Lowland Conifer	Lowland Hardwood	Mesic Birch-Aspen-Spruce-Fir	Mesic Red and White Pine	Mesic Sugar Maple
Category	Net Increase/(Decrease)						
MIH Types	Acres ¹ 517.0	(1,374.7)	289.0	10.1	140.8	527.1	1.1
	% ² 2	(4)	2	2	0	1	1
	Acres ¹ 15.5	(1,089.3)	(121.2)	3.2	7.6	11.6	0.0
	% ² 0	(8)	(2)	2	0	0	0
	Acres ¹ 26.2	(390.7)	928.9	17.1	134.7	13.8	7.8
	% ² 1	(7)	2	1	4	0	0
Lowland Shrub	Acres ¹ 115.5	2.2	97.8	9.1	0.3	0.8	0.9
	% ² NA	NA	NA	NA	NA	NA	NA
	Acres ¹ 3.0	(95.0)	(113.0)	24.0	19.0	0.0	0.0
	% ² 0	(4)	(1)	4	1	0	0
Lowland Emergent	Acres ¹ 6.0	(62.3)	348.1	3.2	0.0	2.4	3.1
	% ² 1	(7)	5	1	0	0	0
	Acres ¹ 0.0	(0.2)	15.4	0.0	0.0	0.0	23.6
Age Classes	Acres ¹ 0	0	5	0	0	0	0
	Young	Acres ¹ 250.8	(21.5)	188.0	5.6	51.1	9.3
		% ² 15	(1)	18	7	2	0
	Immature	Acres ¹ 178.7	(700.3)	2,170.2	2.3	50.4	298.9
		% ² 1	(4)	28	1	0	1
	Mature	Acres ¹ 129.2	(1,079.0)	(1,559.6)	22.5	181.6	247.1
	% ² 1	(4)	(2)	1	1	1	6

Source: USFS 2010b; USFS 2011g.

Notes:

¹ Total acres may be more or less than presented due to rounding.

² Percentage of acres increased or decreased on the federal estate within the entire landscape ecosystem.

³ MIH 14 is not tracked on the federal lands; thus, percentage is NA (not applicable).

5.3.4.2.2 Invasive Non-native Plants

The Land Exchange Proposed Action would result in a reduction of occurrences of invasive non-native species on the federal lands, but an increase to the federal estate of similar occurrences of invasive non-native species on Tracts 1, 2, and 3, including common tansy, orange hawkweed, ox-eye daisy, and thistles. Tracts 4 and 5 would not have an increase of any occurrences of invasive non-native species.

5.3.4.2.3 Threatened and Endangered Plant Species

Endangered, Threatened, and Special Concern Plant Species

There are fewer occurrences of state-listed ETSC plant species on the non-federal lands (one species on Tract 1 and two species on Tract 5) than on the federal lands (10 species), so the USFS would have fewer populations as a result of the Land Exchange Proposed Action (see Table 5.3.4-6). The three species gained in the exchange are *Carex ormostachya*, *Woodsia scopulina*, and *Saxifraga paniculata*. Sections 4.3.4.2.5 and 4.3.4.2.9 provide a discussion of these species. There are no federally listed plant species in St. Louis, Lake, or Cook counties (USFWS 2012). Rulemaking was conducted with the intent to update the list of ETSC species (*Minnesota Rules*, parts 6134.0100 to 6134.0400), with new listings becoming effective on August 19, 2013 (MDNR 2013h). This FEIS considers any new listings, or changes in the previous listings, associated with the updated list.

Though the 10 known state-listed ETSC plant species on the federal lands are not known to occur on the non-federal lands, the Land Exchange Proposed Action would result in an increase to the federal estate of most habitats important to them. The Land Exchange Proposed Action would result in additional grassland habitat, which *Botrychium campestre* and *Botrychium pallidum* occupy. The Land Exchange Proposed Action would also result in an increase to the federal estate of upland deciduous and mixed forest habitats, used by *Botrychium pallidum*, *Botrychium rugulosum*, and *Botrychium simplex*. There would be an increase to the federal estate of aquatic habitats (open water or wetlands) for *Caltha natans*, *Eleocharis nitida*, *Juncus stygius* var. *americanus*, and *Torreyochloa pallida*. According to the MIH analysis, the Land Exchange Proposed Action would result in an increase to the federal estate of lowland black spruce or tamarack habitats, which could mean more habitats for *Platanthera clavellata*, *Pyrola minor*, and *Ranunculus lapponicus*.

Table 5.3.4-6 Increase or Decrease to the Federal Estate of State-listed ETSC Plant Populations under the Land Exchange Proposed Action

Plant Species (State Status/ Global Status ¹)	Federal Lands Populations		Non-federal Lands Populations		Net Species Increase/ (Decrease)
	Total Populations ^{2,3}	Total Individuals ³	Total Populations ^{2,3}	Total Individuals ³	
<i>Botrychium pallidum</i> (SC/G3)	1	2	0	NA	(1)
<i>Botrychium rugulosum</i> (SC/G3)	1	4	0	NA	(1)
<i>Botrychium simplex</i> (SC/G5)	3	905	0	NA	(1)
<i>Caltha natans</i> (E/G5)	1	29	0	NA	(1)
<i>Eleocharis nitida</i> (SC/G4)	1	~486 ft ²	0	NA	(1)
<i>Juncus stygius</i> var. <i>americanus</i> (SC/G5)	1	1	0	NA	(1)
<i>Platanthera clavellata</i> (SC/G5)	1	5	0	NA	(1)
<i>Pyrola minor</i> (SC/G5)	1	10	0	NA	(1)
<i>Ranunculus lapponicus</i> (SC/G5)	1	~919 ft ²	0	NA	(1)
<i>Torreya ochloa pallida</i> (SC/G5)	1	~25 ft ²	0	NA	(1)
<i>Carex ormostachya</i> (SC/G4)	0	NA	1	>20	1
<i>Woodsia scopulina</i> (T/G5)	0	NA	1	2	1
<i>Saxifraga paniculata</i> (SC/G5)	0	NA	1	1,000	1
Total	12	NA	3	NA	(7)

Source: MDNR 2014d.

Notes:

¹ The state status is E – Endangered; T – Threatened; and SC – Species of Special Concern. The global ranks range from G1 to G5. A lower global ranking (e.g., G3) indicates a species at higher global risk than higher ranking (e.g., G5) (NatureServe 2014b).

² Populations are interpreted from MDNR NHIS data using Element Occurrence; this differs from the DEIS, which used colonies as the population estimate.

³ Data included here were provided by the Division of Ecological Resources, MDNR, and were current as of August 5, 2014. These data are not based on an exhaustive inventory of the state. The lack of data for any geographic area shall not be construed to mean that no significant features are present.

Regional Foresters Sensitive Species

The USFS RFSS data layer indicates there are no RFSS plants on the federal lands. However, several state-listed ETSC plant species that occur on the federal lands are also listed as RFSS plants, including *Botrychium pallidum*, *Botrychium rugulosum*, *Botrychium simplex*, *Caltha natans*, *Eleocharis nitida*, *Juncus stygius* var. *americanus*, and *Pyrola minor*. The USFS would have a decrease to the federal estate in these RFSS plant species as a result of the Land Exchange Proposed Action. *Saxifraga paniculata* is a state-listed ETSC plant species that is also listed as a RFSS plant on the Tract 5 lands. The USFS would gain this RFSS plant species under the Land Exchange Proposed Action.

As with the NorthMet Project Proposed Action, the Land Exchange Proposed Action would not affect 20 RFSS plants on the Superior National Forest. In addition, the Land Exchange Proposed Action may affect individuals, but would not be likely to cause a trend to federal listing or loss of viability for the remaining 38 RFSS plants on the Superior National Forest. Please see the Biological Evaluation included in Appendix D for more information about effects to RFSS plants.

There would be the greatest increase to the federal estate in acres of lowland black spruce-tamarack forest (MIH 1; see Table 5.3.4-4) as a result of the Land Exchange Proposed Action, which means there is the highest chance to gain the RFSS plants listed under that category in Table 4.2.4-5, as long as the suitable habitats exist on the non-federal lands. There would be smaller acreage increases of both upland forest (MIH 9) and aquatic habitat (MIH 14), meaning the RFSS plants in those categories could also be gained. The largest acreage decrease to the federal estate would be upland conifer forest (MIH 5). There are no RFSS plants specifically listed under upland conifer forest (MIH 5); however, it is likely that some RFSS plants that occupy upland forest (MIH 9) habitats would also occupy upland conifer forest (MIH 5) habitats and the USFS could therefore have a decrease to the federal estate in RFSS plant species that prefer coniferous upland habitats. There would also be a gain of Rove Formation cliff microhabitats, which are important for a variety of RFSS plants in the Superior National Forest.

5.3.4.2.4 Biodiversity

Biodiversity is described in the Forest Plan as the “variety of life and its ecological processes ... [as well as] ecosystems, which comprise both the communities of organisms within particular habitats, and the physical conditions under which they live” (USFS 2004b). Biodiversity is important to consider for managing natural communities in a sustainable and ecological manner. Several data sources mentioned above and in Section 4.2.4 were compared on an increase or decrease basis to the federal estate to measure or estimate the biodiversity of both the federal and non-federal lands.

The federal land contains a high level of biodiversity because the majority of the parcel has been classified for inclusion in two Sites of High Biodiversity Significance. Additionally, several different native plant communities exist on it, as do 10 state-listed ETSC plant species. Because the non-federal lands have not been fully studied yet, they contain less biodiversity classification since they lack MBS Sites of High Biodiversity Significance and native plant communities. Table 5.3.4-1 provides a summary of the various data used to estimate biodiversity.

In summary, the non-federal lands contain 116.9 acres of MBS Sites of High Biodiversity Significance in the North Shore Highlands subsection and 767.9 acres of MBS Sites of Moderate Biodiversity Significance in the Laurentian Uplands subsection. The Land Exchange Proposed Action would result in a decrease to the federal estate of 6,142.7 acres of MBS Sites of High Biodiversity Significance in the Laurentian Uplands subsection, and an increase of 116.9 acres of MBS Sites of High Biodiversity Significance in the North Shore Highlands subsection. Furthermore, the Land Exchange Proposed Action would result in an increase to the federal estate of 767.6 acres of MBS Sites of Moderate Biodiversity Significance in the Laurentian Uplands subsection. Overall, there would be a decrease to the federal estate of 6,025.8 acres of MBS Sites of High Biodiversity Significance and an increase of 767.6 acres of MBS Sites of Moderate Biodiversity Significance under the Land Exchange Proposed Action. However, several of the non-federal lands have preliminary classifications of Sites as Moderate, High, or Outstanding Biodiversity Significance, which, if approved by the MDNR MBS program, would help balance the exchange.

Native plant community rankings are largely unavailable for the non-federal lands, with the exception of Lake County South, which has one site ranked as “vulnerable” and others ranked as “apparently secure.” Section 4.3.4.2.6 provides further discussion of native plant community types on the Lake County South parcel. The Land Exchange Proposed Action would result in a

decrease to the federal estate of three native plant communities on the federal lands that are ranked as “imperiled” to “vulnerable” in the state. A native plant community increase or decrease comparison cannot be accurately made since rankings are unavailable for much of the non-federal lands.

Endangered, Threatened, and Special Concern Plant Species

As previously stated, the federal lands support 10 known state-listed ETSC plant species, while the non-federal lands currently support three known state-listed ETSC plant species. This would be a decrease to the federal estate in known state-listed species as a result of the Land Exchange Proposed Action.

5.3.4.3 Land Exchange Alternative B

5.3.4.3.1 Cover Types

The effects of Land Exchange Alternative B would be comparable to those from the Land Exchange Proposed Action, although to a lesser extent. A smaller portion of the federal lands (approximately 4,752.6 acres) would be transferred into private ownership for the non-federal Tract 1 lands (approximately 4,926.3 acres), which would be conveyed into USFS ownership. Under this alternative, the USFS would retain a smaller federal parcel located on the northwestern and western sides of the current federal lands, which would create additional linear boundaries for the USFS to maintain (see Section 5.3.1).

Habitat Types

This alternative would result in an overall increase to the federal estate of 173.6 acres of MDNR GAP land cover types. As under the Land Exchange Proposed Action, the greatest increase to the federal estate would be shrubland acreage (1,227.7 acres), and upland conifer forest would have the greatest acreage decrease (928.8 acres), as shown in Table 5.3.4-7 below.

Table 5.3.4-7 Net Increase or Decrease to the Federal Estate of MDNR GAP Land Cover Types under Land Exchange Alternative B

Cover Types	Alternative B: Smaller Federal Parcel Acres	Tract 1 Acres ¹	Net Increase/ (Decrease) Acres
Shrubland	436.9	1,664.6	1,227.7
Aquatic environments	26.3	251.1	224.8
Upland deciduous forest	804.7	999.9	195.2
Cropland/grassland	2.2	31.7	29.5
Lowland deciduous forest	4.7	17.4	12.7
Upland conifer-deciduous mixed forest	17.8	0.0	(17.8)
Disturbed	29.1	0.0	(29.1)
Lowland coniferous forest	2,064.8	1,524.2	(540.6)
Upland coniferous forest	1,366.1	437.3	(928.8)
Total ²	4,752.6	4,926.2	173.6

Source: MDNR 2006b.

Notes:

¹ According to Tract 1 land cover type table (see Table 4.3.4-11).

² Total acres may be more or less than presented due to rounding.

Culturally Important Plants

As with the Land Exchange Proposed Action, Land Exchange Alternative B would result in additional wild rice beds on the federal estate from the acquisition of Tract 1, but would not result in a change in harvesting opportunities for the public. Section 5.3.4.2 provides additional information on wild rice.

As with the Land Exchange Proposed Action, see Section 4.2.9.3.3 for a discussion of natural resources culturally important to the Bands.

Minnesota Biological Survey

Land Exchange Alternative B would result in a decrease to the federal estate of 4,573.1 acres of MBS Sites of High Biodiversity Significance and a decrease of 0.3 acre of MBS Sites of Moderate Biodiversity Significance within the Laurentian Uplands subsection (see Table 5.3.4-1). Portions of the west end of One Hundred Mile Swamp would remain in federal ownership. Furthermore, Land Exchange Alternative B would result in removal from the Superior National Forest of three native plant communities that are ranked as “imperiled” to “vulnerable” in the state. As previously discussed, Tract 1 does not contain any MBS Sites of Biodiversity Significance or native plant communities, so, unlike the Land Exchange Proposed Action, the federal estate would not have an increase of either MBS sites or native plant communities under this alternative.

Management Areas

Lands included as part of Land Exchange Alternative B are currently managed under the General Forest – Longer Rotation Management Area (93 percent) and the General Forest Management Area (7 percent) (see Table 5.3.4-8). The majority of Tract 1 (94 percent) would be allocated to the General Forest Management Area upon completion of Land Exchange Alternative B, and the

remaining area would be managed under the cRNA Management Area (6 percent). Land Exchange Alternative B would be comparable to the Land Exchange Proposed Action in that cRNA lands would be increased on the federal estate, but Riparian Areas would not be. Section 5.3.1 describes the management areas in detail.

Table 5.3.4-8 Net Increase or Decrease to the Federal Estate of Management Areas under Land Exchange Alternative B

Category	Alternative B: Smaller Federal Parcel				Net Increase/ (Decrease)
	Acres	%	Acres	%	
General Forest	355.3	7	4,619.3	94	4,264.0
General Forest - Longer Rotation	4,397.3	93	0.0	0	(4,397.3)
Potential/candidate Research Natural Areas	0.0	0	306.9	6	306.9
Riparian Areas	0.0	0	0.0	0	0

Source: USFS 2011j.

Ecological Land Types

Land Exchange Alternative B would result in a decrease to the federal estate of five ELTs, including ELT 1, 2, 6, 13, and 16, which are currently located on the proposed smaller federal parcel. The ELTs are unavailable for Tract 1, and so a comparison cannot be made.

Management Indicator Habitats

Land Exchange Alternative B would result in an increase to the federal estate in upland forest (MIH 1; 1,411.8 acres) and aquatic habitat (MIH 14; 206.2 acres); however, there would be a decrease of upland conifer forest (MIH 5; 1,084.6 acres) and lowland black spruce-tamarack forest (MIH 9; 261.1 acres) (see Table 5.3.4-9). Though not considered MIH types, there would be a decrease to the federal estate of lowland shrubland habitat (272.1 acres) and an increase of lowland emergent wetlands (249.6 acres). Similar to the Land Exchange Proposed Action, the aquatic habitat (MIH 14) type is not fully mapped on lands that are part of Land Exchange Alternative B, resulting in an apparent increase to the federal estate in this category; however, this habitat type does occur on these lands.

There would be a large increase to the federal estate of immature forest stands (1,933.9 acres) with lesser amounts of young stands (262.7 acres), corresponding to a decrease of mature forest stands (2,114.5 acres). Land Exchange Alternative B would not result in a change to the federal estate of large patches (stands over 300 acres) of mature upland forest, as none exist on the Alternative B: Smaller Federal Parcel lands (USFS 2012c) and patch data does not exist for the Tract 1 lands.

Table 5.3.4-9 Net Increase or Decrease to the Federal Estate of MIH Types and Age Classes under Land Exchange Alternative B

Category	Alternative B: Smaller Federal Parcel Acres ²	Tract 1 Acres ^{1,2}	Net Increase/ (Decrease) Acres
MIH Types			
MIH 1 (Upland Forest)	954.2	2,366.0	1,411.8
MIH 5 (Upland Conifer Forest)	1,138.8	54.2	(1,084.6)
MIH 9 (Lowland Black Spruce-tamarack Forest)	2,078.7	1,817.6	(261.1)
MIH 14 (Aquatic Habitats)	0.0	206.2	206.2
Lowland Shrubland	385.4	113.3	(272.1)
Lowland Emergent	115.4	365.0	249.6
Upland Grass	0.0	0.0	0.0
Age Classes			
Young	271.1	533.8	262.7
Immature	1,325.9	3,259.8	1,933.9
Mature	2,574.7	460.2	(2,114.5)

Source: USFS 2010b.

Notes:

¹ According to Tract 1 lands MIH table (see Table 4.3.4-3).

² Total acres may be more or less than presented due to rounding.

Landscape Ecosystems

Land Exchange Alternative B would result in a decrease to the federal estate of 1,411.6 acres of the Jack Pine-Black Spruce landscape ecosystem (0.46 percent decrease), but result in an increase of 486.2 acres of the Lowland Conifer landscape ecosystem (0.04 percent increase). Furthermore, there would be an increase in representation in the Dry-Mesic Red and White Pine landscape ecosystem (589.2 acres; 0.10 percent increase), Mesic Red and White Pine landscape ecosystem (528.0 acres; 0.69 percent increase), and the Mesic Birch-Aspen-Spruce-Fir landscape ecosystem (0.9 acres; less than 0.01 percent increase), and an overall increase to the federal estate of 192.7 acres.

Similar to the Land Exchange Proposed Action, Land Exchange Alternative B would result in an increase to the federal estate in acreage of MIH types and age classes within various landscape ecosystems, and a decrease in acreage in others (see Table 5.3.4-10). The greatest percentage increase to the federal estate in MIH acreage within a landscape ecosystem is upland forest (MIH 1) in the Lowland Conifer and Dry-Mesic Red and White Pine landscape ecosystems, while the greatest decrease is upland conifer forest (MIH 5) in the Jack Pine-Black Spruce landscape ecosystem. The largest percentage increase to the federal estate in age class acreage within a landscape ecosystem is the immature age class in the Lowland Conifer landscape ecosystem, while the largest decrease is in the immature age class in the Jack Pine-Black Spruce landscape ecosystem and the mature age classes within the Jack Pine-Black Spruce and Lowland Conifer landscape ecosystems. Overall, the Dry-Mesic Red and White Pine landscape ecosystem would have the highest acreage increase to the federal estate of MIH types and age classes and the Jack Pine-Black Spruce landscape ecosystem would have the highest acreage decrease of MIH types and age classes.

Table 5.3.4-10 Net Increase or Decrease to the Federal Estate of MIH Types and Age Classes within Landscape Ecosystems in the Superior National Forest under Land Exchange Alternative B

Landscape Ecosystem Name		Dry-Mesic Red and White Pine	Jack Pine- Black Spruce	Lowland Conifer	Lowland Hardwood	Mesic Birch- Aspen- Spruce- Fir	Mesic Red and White Pine	Mesic Sugar Maple
Category		Net Increase/(Decrease)						
MIH Types	MIH 1	Acres ¹ 437.8	(1,007.1)	340.3	0.0	0.9	501.1	0.0
		% ² 2	(3)	2	0	0	1	0
	MIH 5	Acres ¹ 6.0	(998.2)	(100.1)	0.0	0.0	7.7	0.0
		% ² 0	(7)	(2)	0	0	0	0
	MIH 9	Acres ¹ 26.2	(290.9)	(10.5)	0.0	0.0	13.9	0.0
		% ² 1	(6)	0	0	0	0	0
	MIH 14	Acres ¹ 114.2	2.2	89.6	0.0	0.0	0.2	0.0
		% ^{2,3} NA	NA	NA	NA	NA	NA	NA
Lowland Shrub		Acres ¹ 0.0	(66.4)	(207.3)	0.0	0.0	0.1	0.0
		% ² 0	(3)	(1)	0	0	0	0
	Lowland Emergent	Acres ¹ 5.0	(23.5)	265.7	0.0	0.0	2.4	0.0
		% ² 1	(3)	4	0	0	0	0
Upland Grass		Acres ¹ 0.0	0.0	0.0	0.0	0.0	0.0	0.0
		% ² 0	0	0	0	0	0	0
	Young	Acres ¹ 229.4	(21.5)	45.5	0.0	0.0	9.3	0.0
		% ² 14	(1)	4	0	0	0	0
Age Classes	Immature	Acres ¹ 148.5	(528.7)	2,014.3	0.0	0.9	298.9	0.0
		% ² 1	(3)	26	0	0	1	0
	Mature	Acres ¹ 92.1	(726.1)	(1,709.8)	0.0	0.0	217.1	0.0
		% ² 1	(3)	(3)	0	0	1	0

Source: USFS 2010b; USFS 2011g.

Notes:

¹ Total acres may be more or less than presented due to rounding.

² Percentage of acres increased or decreased on the federal estate within the entire landscape ecosystem.

³ MIH 14 is not tracked on the federal lands; thus, percentage is NA.

5.3.4.3.2 Invasive Non-native Plants

Land Exchange Alternative B would result in a reduction of occurrences of invasive non-native species on the smaller federal parcel, but in an increase to the federal estate of similar occurrences of invasive non-native species on Tract 1, including common tansy, orange hawkweed, and ox-eye daisy.

5.3.4.3.3 Threatened and Endangered Plant Species

Endangered, Threatened, and Special Concern Plant Species

Under Land Exchange Alternative B, a smaller portion of the federal lands would be exchanged for Tract 1. The same 10 ETSC plant species would be exchanged as for the Land Exchange Proposed Action, but fewer colonies would be exchanged. There is one known state-listed ETSC

plant species located on Tract 1 (*Carex ormostachya*). Overall, 12 populations of 10 different species on the smaller federal parcel would be exchanged for one population of one species on Tract 1 (see Table 5.3.4-11). Rulemaking was conducted with the intent to update the list of ETSC species (*Minnesota Rules*, parts 6134.0100 to 6134.0400), with new listings becoming effective on August 19, 2013 (MDNR 2013h). This FEIS considers any new listings, or changes in the previous listings, associated with the updated list.

Table 5.3.4-11 Increase or Decrease to the Federal Estate of State-listed ETSC Plant Populations under Land Exchange Alternative B

Plant Species (State Status/ Global Status ¹)	Alternative B: Smaller Federal Parcel Populations		Tract 1 Populations		Net Species Increase/ (Decrease)
	Total Populations ^{2,3}	Total Individuals ^{3,4}	Total Populations ^{2,3}	Total Individuals ³	
<i>Botrychium pallidum</i> (SC/G3)	1	2	0	NA	(1)
<i>Botrychium rugulosum</i> (SC/G3)	1	4	0	NA	(1)
<i>Botrychium simplex</i> (SC/G5)	3	905	0	NA	(1)
<i>Caltha natans</i> (E/G5)	1	29	0	NA	(1)
<i>Eleocharis nitida</i> (SC/G4)	1	~486 ft ²	0	NA	(1)
<i>Juncus stygius</i> var. <i>americanus</i> (SC/G5)	1	1	0	NA	(1)
<i>Platanthera clavellata</i> (SC/G5)	1	3	0	NA	(1)
<i>Pyrola minor</i> (SC/G5)	1	10	0	NA	(1)
<i>Ranunculus lapponicus</i> (SC/G5)	1	~919 ft ²	0	NA	(1)
<i>Torreyochloa pallida</i> (SC/G5)	1	~25 ft ²	0	NA	(1)
<i>Carex ormostachya</i> (SC/G4)	0	NA	1	>20	1
Total	12	NA	1	NA	(9)

Source: MDNR 2014d.

Notes:

¹ The state status is E – Endangered; T – Threatened; and SC – Species of Special Concern. The global ranks range from G1 to G5. A lower global ranking (e.g., G3) indicates a species at higher global risk than higher ranking (e.g., G5) (NatureServe 2014b).

² Populations are interpreted from MDNR NHIS data using Element Occurrence; this differs from the DEIS, which used colonies as the population estimate.

³ Data included here were provided by the Division of Ecological Resources, MDNR, and were current as of August 5, 2014. These data are not based on an exhaustive inventory of the state. The lack of data for any geographic area shall not be construed to mean that no significant features are present. NA = Not Applicable.

⁴ Where the number of individuals could not be determined without damaging the population, then patch size was used as a representative abundance measure.

Regional Foresters Sensitive Species

The USFS RFSS data layer indicates there are no RFSS plants on the federal lands, which includes the smaller federal parcel. However, several state-listed ETSC plant species occur on the smaller federal parcel that are also RFSS plants, including *Botrychium pallidum*, *Botrychium rugulosum*, *Botrychium simplex*, *Caltha natans*, *Eleocharis nitida*, *Juncus stygius* var. *americanus*, and *Pyrola minor*.

As with the Land Exchange Proposed Action, the Land Exchange Alternative B would not affect 20 RFSS plants on the Superior National Forest. In addition, the Land Exchange Alternative B may affect individuals, but would not be likely to cause a trend to federal listing or loss of

viability for the remaining 38 RFSS plants on the Superior National Forest. Please see the Biological Evaluation included in Appendix D for more information about effects to RFSS plants.

There would be an increase to the federal estate in acres of upland forest (MIH 1) and aquatic habitat (MIH 14) as a result of Land Exchange Alternative B (see Table 5.3.4-9), which means there would be the greatest opportunity to gain the RFSS plants listed under those categories in Table 4.2.4-5. There would be a decrease to the federal estate in acreage of upland conifer forest (MIH 5) and lowland black spruce-tamarack forest (MIH 9), which means the RFSS plant species that prefer these habitat types and have suitable microhabitats may also be decreased on National Forest System lands.

5.3.4.3.4 Biodiversity

The smaller federal parcel contains a high level of biodiversity because the majority of the parcel has been classified for inclusion in two MBS Sites of High Biodiversity Significance. Additionally, several different native plant communities exist on it, as well as 10 state-listed ETSC plant species. Because Tract 1 has not been fully studied, it is assumed to contain less biodiversity because it lacks MBS Sites of High Biodiversity Significance and native plant communities. However, inclusion of the preliminary Site of Outstanding Biodiversity Significance on Tract 1 would balance the exchange, if not make it more biodiverse than the smaller federal parcel. Table 5.3.4-1 provides a summary of the various data used to estimate biodiversity.

Land Exchange Alternative B would result in a decrease to the federal estate of 4,573.1 acres of MBS Sites of High Biodiversity Significance and a decrease of 0.3 acres of MBS Sites of Moderate Biodiversity Significance within the Laurentian Uplands subsection (see Table 5.3.4-1). Portions of the west end of One Hundred Mile Swamp would remain in federal ownership.

Furthermore, Land Exchange Alternative B would result in removal from the Superior National Forest of three native plant community sites that are ranked as “imperiled” to “vulnerable” in the state. As previously discussed, Tract 1 does not contain any MBS Sites of Biodiversity Significance or native plant communities, so, unlike the Land Exchange Proposed Action, the federal estate would not have an increase of either MBS Sites or native plant communities under this alternative.

5.3.4.4 Land Exchange No Action Alternative

Under the Land Exchange No Action Alternative, the Superior National Forest would have an ongoing responsibility for managing vegetation resources on the federal lands in accordance with the Forest Plan. The Land Exchange No Action Alternative would not change the USFS’s responsibility for managing vegetation resources and would result in no further effects on existing vegetation.

5.3.4.4.1 Cover Types

Under the Land Exchange No Action Alternative, the current federal lands would remain in federal ownership and the lands would continue to be managed under the General Forest – Longer Rotation Management Area and the General Forest Management Area. Direct and

indirect effects of the Land Exchange No Action Alternative on cover types would be unchanged, as the management of these forests has occurred on site in the past. None of the federal lands currently have any vegetation management actions planned in the near future, regardless of whether the Land Exchange Proposed Action were to occur.

5.3.4.4.2 Invasive Non-native Plants

Non-native species may still invade the federal lands as a result of logging, mineral exploration, vehicle traffic, and natural disturbances, but are likely to do so much more slowly than they would under the Land Exchange Proposed Action. The proximity of the federal lands to the already-disturbed Plant Site may put the federal lands at risk of eventual colonization by invasive non-native species.

5.3.4.4.3 Threatened and Endangered Plant Species

Under the Land Exchange No Action Alternative, timber harvests are expected to continue to occur on the federal lands, though there are not any planned in the near future. Effects on ETSC plant species and RFSS plants, for different management techniques, are addressed in the Forest Plan (USFS 2004b). As discussed in the Biological Evaluation, the Land Exchange No Action Alternative would not have effects on RFSS species.

5.3.4.4.4 Biodiversity

The Land Exchange No Action Alternative would not result in any change to biodiversity on the federal lands.

-Page Intentionally Left Blank-

5.3.5 *Wildlife*

This section describes the environmental consequences of the Land Exchange to wildlife on the federal and non-federal lands. Effects from the change in federal ownership could be either beneficial or adverse, based on the change in species occurrences, habitat, and habitat connectivity on land that is under direct federal control. Effects due to the NorthMet Project Proposed Action are discussed in Section 5.2.5.

Rulemaking was conducted with the intent to update the list of ETSC species (*Minnesota Rules*, parts 6134.0100 to 6134.0400), with new listings becoming effective on August 19, 2013 (MDNR 2013h). This FEIS considers any new listings, or changes in the previous listings, associated with the updated list.

A Biological Assessment that provides further information on federally listed species, and a Biological Evaluation that contains further information about RFSS have been prepared. The Biological Assessment and Biological Evaluation are included in Appendix D. The Biological Assessment analyzes impacts to the Canada lynx, gray wolf, and northern long-eared bat. Land Exchange alternatives were analyzed in the Biological Assessment for the NorthMet Mining Project and Land Exchange. The organization of the methodologies and discussion in the Biological Assessment and Biological Evaluation may be different from the FEIS. Both documents also contain determinations of effect for the species discussed.

The Land Exchange Proposed Action would have mixed effects for the Canada lynx. It would result in an increase in suitable habitat for lynx and for snowshoe hare (prey species) on the federal estate (although the amount of unsuitable lynx habitat would also increase). It would also result in a decrease of denning habitat and a decrease to the federal estate within designated LAUs. Critical lynx habitat would not change regardless of ownership.

The Land Exchange Proposed Action would result in an increase in the number of occurrences and forage habitat availability for the gray wolf within the federal estate, but would result in a decrease in cover habitat. The Land Exchange Proposed Action would result in a net decrease of potential northern long-eared bat roosting habitat but an increase in foraging habitat within the federal estate.

Overall, the Land Exchange Proposed Action would result in an increase (to the federal estate) of the number of occurrences and habitat availability for two state-listed species of special concern, which include the Laurentian tiger beetle and the trumpeter swan (see Table 5.3.5-1). The Land Exchange Proposed Action is not expected to result in changes to the three additional state-listed and special concern species, which include the wood turtle, the eastern heather vole, and the yellow rail.

Under the Land Exchange Proposed Action, one additional state-listed species and 22 additional SGCN would be affected due to their presence on the federally held lands. The Land Exchange Proposed Action would result in an increase of up to 579.6 acres of habitat within the federal state in the Superior National Forest. While forested habitat would be decreased, shrubland/grassland and aquatic habitats would be increased as part of the Land Exchange Proposed Action. Under the Land Exchange Proposed Action, lands to be acquired would be managed by the USFS in accordance with the current Forest Plan. No activities are planned on these lands.

Under the Land Exchange Alternative B, one additional state-listed species but one less SGCN would be affected because they occur within the federal estate. Forest habitat under federal ownership would also decrease, though by a smaller amount than under the Land Exchange Proposed Action. Similarly, the Land Exchange Alternative B would result in an increase of 173.6 acres of habitat to the federal estate, with a distribution of habitat similar to the Land Exchange Proposed Action. As with the Land Exchange Proposed Action, lands acquired under the Land Exchange Alternative B would be managed by the USFS in accordance with the current Forest Plan. There are no activities planned on these lands.

As discussed in the Biological Evaluation, the USFS determined that the Land Exchange Proposed Action and Land Exchange Alternative B may affect individuals but are not likely to cause a trend to federal listing or loss of viability for 18 RFSS terrestrial wildlife species on the Superior National Forest.

Under the Land Exchange No Action Alternative, no action would be taken. No lands would be exchanged and no changes in wildlife species on the federal estate would be anticipated. As discussed in the Biological Evaluation, the Land Exchange No Action Alternative would have no effect on RFSS species.

Table 5.3.5-1 Increase or Decrease of Special Status Wildlife Species on the Federal Estate Resulting from the Land Exchange Proposed Action and Alternatives

Alternative	Increase or (Decrease) of Special Status Wildlife Species			
	Federally Listed Species	State-listed Species	Regional Forester Sensitive Species	Species of Greatest Conservation Need
Land Exchange Proposed Action	0	2	0	22
Land Exchange Alternative B	0	2	0	(1)
Land Exchange No Action Alternative	0	0	0	0

Table 5.3.5-2 Increase or Decrease of Key Habitat Types on the Federal Estate Resulting from the Land Exchange Proposed Action and Alternatives

Alternative	Increase or (Decrease) of Acres ¹ of Key Habitat Types				Total Net Increase or (Decrease)
	Mature Upland Forest, Continuous Upland/Lowland Forest (MIH1-13)	Open Ground, Bare Soils (no MIH)	Grassland and Brushland, Early Successional Forest (no MIH)	Aquatic Environments (MIH 14)	
Land Exchange Proposed Action	(787.9)	(63.8)	1,224.9	206.5	579.6
Land Exchange Alternative B	(1,279.3)	(29.1)	1,257.2	224.8	173.6
Land Exchange No Action Alternative	0	0	0	0	0

Source: Tables 5.3.4-2 and 5.3.4-7.

Note:

¹ Total acres may be more or less than presented due to rounding.

5.3.5.1 Methodology and Evaluation Criteria

Evaluation was conducted to determine the potential effect that the Land Exchange Proposed Action would have on wildlife on the federal estate species from the following:

- A change in federal and state-listed ETSC, SGCN, RFSS, and other wildlife species; and
- A change in habitat availability, prey species habitat availability, habitat connectivity, and adjacent land use.

Analysis of wildlife species affected by the Land Exchange Proposed Action was guided by evaluation criteria that were developed by the USFS and other Co-lead Agencies, which included a comparison of the vegetation land cover and habitat types, forest age classes (young, immature, and mature), large mature forest patches, road and trail densities, federal and state-listed ETSC, SGCN, RFSS, and other wildlife species. GIS data and field observations for these categories were gathered to the extent possible and then compared over an area of analysis that included the federal and non-federal lands and LAU.

5.3.5.2 Land Exchange Proposed Action

5.3.5.2.1 Federally Listed Species

Canada Lynx

The federal lands of the Land Exchange Proposed Action include lynx habitat and habitat for lynx prey species. Lynx habitat includes a wide variety of upland and lowland habitats and forest types/ages, shrubland, and grasslands, but excludes aquatic environments and disturbed areas. Preferred denning habitat is typically found in mature forest and is generally more dependent on forest age classes, with trees older than saplings and with a dbh greater than 5 inches (immature and mature age classes; see Table 4.3.4-3). Snowshoe hare are the primary prey species for the

Canada lynx, and hare habitat includes all types and age classes of forest and shrubland, but not aquatic environments, disturbed areas, or grassland/croplands (see Table 5.3.5-3).

Table 5.3.5-3 Increase or Decrease in Suitable Habitat Types for Canada Lynx and Prey Species on the Federal Estate Resulting from the Land Exchange Proposed Action and Alternatives

Parcel	General Suitable Lynx Habitat (Acres ¹)	Suitable Denning Habitat (Acres ¹)	Suitable Snowshoe Hare Forage Habitat (Acres ¹)	Unsuitable Lynx Habitat (Acres ¹)
Land Exchange Proposed Action				
Federal Lands	6,371.5	5,393.4	6,365.3	123.9
Non-Federal Lands Total	6,808.4	5,364.3	6,776.7	250.8
Tract 1 – Hay Lake	4,675.1	3,720.0	4,643.4	251.1
Tract 2 – Lake County North	263.3	219.5	263.3	1.8
Tract 2 – Lake County South	112.8	48.4	112.8	4.0
Tract 3 – Wolf Lands 1	125.9	113.9	125.9	0.0
Tract 3 – Wolf Lands 2	767.9	683.8	767.9	0.0
Tract 3 – Wolf Lands 3	277.4	96.7	277.4	0.0
Tract 3 – Wolf Lands 4	404.7	359.7	404.7	0.0
Tract 4 – Hunting Club	150.7	92.2	150.7	9.6
Tract 5 – McFarland Lake	30.6	30.1	30.6	0.2
Net Increase/(Decrease)	436.9	(29.1)	411.4	126.9
Land Exchange Alternative B				
Smaller Federal Parcel	4,697.2	3,912.9	4,695.0	55.4
Tract 1 – Hay Lake	4,675.1	3,720.0	4,643.4	251.1
Net Increase/(Decrease)	(22.1)	(192.9)	(51.6)	195.7

Source: Tables 5.2.5-5, 4.3.4-3, and 4.3.4-8.

Note:

¹ Total acres may be more or less than presented due to rounding.

As shown in Table 5.3.5-3, the federal lands of the Land Exchange Proposed Action include 6,371.5 acres of suitable general habitat for lynx. The non-federal lands include a total of 6,808.4 acres of potentially suitable habitat, which is an increase of 436.9 acres. Aquatic environments and disturbed areas are considered unsuitable habitat, along with lowlands with dead trees (though this habitat was not specifically called out in habitat/cover data). The Land Exchange Proposed Action would also result in an increase to the federal estate of 411.4 acres of hare habitat. However, the Land Exchange Proposed Action would result in a decrease to the federal estate of 29.1 acres of denning habitat and an increase of 126.9 acres of unsuitable lynx habitat.

Lynx may utilize snow packed trails and roads as travel corridors as they are energetically easier to navigate, but they do not rely strictly on them. The federal lands do not contain any established snow packed trails (such as snowmobile trails) but are crossed by 6.9 miles of road surface. The non-federal lands are crossed by 0.03 mile of snow packed trail (snowmobile trail) and 2.2 miles of roads. The Land Exchange Proposed Action would result in a decrease to the federal estate of 4.7 miles of road and an increase to the federal estate of 0.03 mile of snow packed trails available for lynx use (see Table 5.3.5-4).

Table 5.3.5-4 Increase or Decrease of Lynx Travel Corridors on the Federal Estate Resulting from the Land Exchange Proposed Action and Alternatives

Travel廊道 Type	Established Snow Pack Trails (Miles)	Established Roads (Miles)
Land Exchange Proposed Action		
Federal Lands	0.0	6.9
Non-Federal Lands Total	0.03	2.2
Tract 1 – Hay Lake	0.0	2.2
Tract 2 – Lake County North	0.0	0.0
Tract 2 – Lake County South	0.0	0.0
Tract 3 – Wolf Lands 1	0.0	0.0
Tract 3 – Wolf Lands 2	0.0	0.0
Tract 3 – Wolf Lands 3	0.03	0.0
Tract 3 – Wolf Lands 4	0.0	0.0
Tract 4 – Hunting Club	0.0	0.0
Tract 5 – McFarland Lake	0.0	0.0
Net Increase/(Decrease)	0.03	(4.7)
Land Exchange Alternative B		
Smaller Federal Parcel	0.0	6.9
Tract 1 – Hay Lake	0.0	2.2
Net Increase/(Decrease)	0.0	(4.7)

Source: USFS 2011e.

Land ownership immediately adjacent to the federal lands is a mix of private, state, and federal. The proximity of private lands and disturbance to the north and west may limit lynx passage and utilization of habitat on the federal lands.

Overall, the land ownership patterns surrounding the non-federal lands are mixed. Federal land proximity and, thus potential habitat connectivity, is marginal on Tract 1. Connectivity on the other tracts is generally more favorable. Located in less developed areas of the Superior National Forest, these tracts are generally bordered by federal, state, or county lands and are intended to reduce fragmentation. As such, the Land Exchange Proposed Action is likely to result in generally improved habitat connectivity overall.

Because all federal and non-federal lands are located within lynx critical habitat and would remain so regardless of ownership, the Land Exchange Proposed Action would not result in a change to lynx critical habitat to the federal estate. As previously discussed, LAU were identified for purposes of analysis and development of conservation measures for lynx (USFS 2004b). The federal lands are located within LAU 12 and the non-federal lands are located in LAU 4, 16, 21, 22, and 42. Tract 1 is not located within an LAU. The USFS indicated that no development or activities are planned on the non-federal lands, which means that there would be no increase in unsuitable habitat due to the Land Exchange Proposed Action (see Table 5.3.5-5). As such, the percentage of currently unsuitable habitat in the overall LAU is not expected to change, nor would it affect the Forest Plan condition that unsuitable habitat not exceed 30 percent of the LAU (USFS 2013).

Table 5.3.5-5 Increase or Decrease in Lynx Analysis Units on the Federal Estate Resulting from the Land Exchange Proposed Action and Alternatives

Parcel	Lynx Analysis Unit	Total Acres ¹ of Proposed Land Exchange Federal/Non-Federal Land Within LAU	Overall Lynx Analysis Unit Acreage ¹	Current Percentage (%) of LAU Unsuitable (Determined by USFS)
Land Exchange Proposed Action				
Federal Parcel	12	6,495.4	70,980.5	4.0
Non-Federal Lands Subtotal		2,149.7		
Tract 1 – Hay Lake	No LAU	NA	NA	NA
Tract 2 – Lake County North	16	265.2	76,108.3	4.4
Tract 2 – Lake County South	22	116.9	58,154.2	1.6
Tract 3 – Wolf Lands 1	16	126.0	76,108.3	4.4
Tract 3 – Wolf Lands 2	21	768.0	73,265.8	4.2
Tract 3 – Wolf Lands 3	21	277.5	73,265.8	4.2
Tract 3 – Wolf Lands 4	21	404.8	73,265.8	4.2
Tract 4 – Hunting Club	4	160.4	55,071.4	4.9
Tract 5 – McFarland Lake	42	30.9	32,305.4	1.9
Net Increase/(Decrease)		(4,345.7)		
Land Exchange Alternative B				
Smaller Federal Parcel	12	4,752.7		
Tract 1 – Hay Lake	No LAU	NA	NA	NA
Net Increase/(Decrease)		(4,752.7)		

Source: Superior National Forest Monitoring and Evaluation Report (USFS 2009a)

Note:

¹ Total acres may be more or less than presented due to rounding.

The Land Exchange Proposed Action would have mixed effects for the Canada lynx. It would result in an increase to the federal estate of overall suitable habitat for lynx and for snowshoe hare (prey species) to the federal estate (although the amount of unsuitable lynx habitat would also increase). It would also result in a decrease to the federal estate of denning habitat and a decrease of federal lands within designated LAU. Critical lynx habitat would not change regardless of ownership. Effects on the Canada lynx and its critical habitat are described in more detail in the Biological Assessment.

Gray Wolf

The federal lands are likely part of a territory occupied by a single pack of wolves. The federal lands are dominated by trees that range in age from immature to mature, which is adequate cover habitat for wolves. Approximately 271 acres of young forest are present for forage opportunities on the federal lands and 778 acres are present on the non-federal lands (see Table 4.3.4-3). There are 5,393.4 acres of cover habitat on the federal lands and 5,364.3 acres on the non-federal lands (see Table 5.3.5-6). Gray wolves or their sign were observed on Tracts 1, 2, 3, and 5.

Table 5.3.5-6 Increase or Decrease in Gray Wolf Habitat on the Federal Estate Resulting from the Land Exchange Proposed Action and Alternatives

Parcel	Forage Habitat (Acres)	Cover Habitat (Acres ¹)
Land Exchange Proposed Action		
Federal Lands	271.1	5,393.4
Non-Federal Lands Total	778.2	5,364.3
Tract 1 – Hay Lake	533.8	3,720.0
Tract 2 – Lake County North	24.4	219.5
Tract 2 – Lake County South	43.3	48.4
Tract 3 – Wolf Lands 1	2.2	113.9
Tract 3 – Wolf Lands 2	7.6	683.8
Tract 3 – Wolf Lands 3	130.4	93.7
Tract 3 – Wolf Lands 4	9.5	359.7
Tract 4 – Hunting Club	27.0	92.2
Tract 5 – McFarland Lake	0.0	30.1
Net Increase/(Decrease)	507.1	(29.1)
Land Exchange Alternative B		
Smaller Federal Parcel	271.1	3,912.9
Tract 1 – Hay Lake	533.8	3,720.0
Net Increase/(Decrease)	262.7	(192.9)

The amount of cover habitat is similar between the federal and non-federal lands, but the non-federal lands include more potential forage habitat; therefore, the Land Exchange Proposed Action would result in a very small decrease (29.1 acres) to the federal estate of cover habitat but an increase to the federal estate of forage habitat (507.1) for the gray wolf. Overall, the Land Exchange Proposed Action would result in an increase (to the federal estate) of the number of occurrences and habitat availability for the gray wolf.

Northern Long-Eared Bat

Potential summer roosting and foraging habitat for the northern long-eared bat is present and individuals have been observed on the federal lands, though no hibernacula have been observed. Similarly, both forage and potential summer roosting habitat is present on the non-federal lands, though no hibernacula have been observed. Bats were observed, though not identified to species, on Tract 1 during field studies in 2009. The Land Exchange Proposed Action would result in a net decrease of mature forest habitat to the federal estate, but an increase in grassland/ brushland, which constitutes a decrease in potential bat roosting habitat but increase in foraging habitat within the federal estate. Effects on the northern long-eared bat are described in more detail in the Biological Assessment and Biological Evaluation.

5.3.5.2.2 State-listed Species

Moose

There is habitat present on the federal lands for the moose, and individuals and their sign have been observed during surveys. Similarly, there is habitat present, and moose individuals or their sign have been observed on Tracts 1, 2, and 3. The Land Exchange Proposed Action would result in a decrease of mature mixed forest types on the federal estate, but an increase in moose preferred habitats, including early successional forests, brushland, and aquatic environments. As

moose or their sign have been observed on both the federal and non-federal lands, there would be neither an increase nor decrease in occurrences to the federal estate.

Little Brown Bat

Habitat for the little brown bat is present and individuals have been observed on the federal lands, though no hibernacula have been observed. Similarly, both forage and potential summer roosting habitat may be present on the non-federal lands, though no hibernacula have been observed. Bats were observed, though not identified to species, on Tract 1 during field studies in 2009. The Land Exchange Proposed Action would result in a net decrease of mature forest habitat to the federal estate, but an increase in grassland/ brushland, which constitutes a decrease in potential bat roosting habitat but increase in foraging habitat within the federal estate.

Eastern Pipistrelle

Habitat for the eastern pipistrelle is present on the federal lands, but no hibernacula or individuals have been observed. Similarly, both forage and potential summer roosting habitat may be present on the non-federal lands, though no hibernacula have been observed. Bats were observed, though not identified to species, on Tract 1 during field studies in 2009. The Land Exchange Proposed Action would result in a net decrease of mature forest habitat to the federal estate, but an increase in grassland/ brushland, which constitutes a decrease in potential bat roosting habitat but increase in foraging habitat within the federal estate.

Northern Goshawk

The northern goshawk may be occasionally present since northern goshawk nests have been observed on the federal parcel. Northern goshawk individuals and nests have also been identified on Tract 1 since 2010, and an active northern goshawk territory (Pike Mountain 2 territory) has been identified and is being monitored by the MDNR. According to the MDNR NHIS database, there have also been northern goshawk observations within 10 miles of the non-federal lands (Tract 1, Tract 3, and Tract 4). More forested habitat for the species is present on the federal lands than the non-federal lands (see Table 5.3.5-2). As such, the Land Exchange Proposed Action would result in a decrease of forested habitat available for the northern goshawk on the federal estate.

Boreal Owl

Mature coniferous and deciduous forests are available as potential habitat for the boreal owl on the federal lands and non-federal lands. However, there would be a decrease of these forests to the federal estate under the Land Exchange Proposed Action (see Table 5.3.5-2). No boreal owls are known to occur on the non-federal lands, and one boreal owl was observed near the federal lands in 1988 to 1989. According to the MDNR NHIS database, there have been boreal owl observations within 10 miles of the non-federal lands (Tract 2, Tract 3, and Tract 5). It is unlikely boreal owls use either the federal or non-federal lands often.

Wood Turtle

The only known population of wood turtles near the federal lands is downstream from the Mine Site, along the southern border of the federal lands. Though there is no known suitable habitat for wood turtles on the federal lands and no individuals are known to occur, wood turtles may use

adjacent areas to the south of the federal lands. Similarly, no wood turtles or optimal wood turtle habitat was identified on the non-federal lands. According to the MDNR NHIS database, there have been wood turtle observations within 10 miles of the non-federal lands (Tract 1, Tract 2, and Tract 3).

Given that no wood turtles or wood turtle habitat were identified on either the federal or non-federal lands, the Land Exchange Proposed Action would not result in an increase or decrease of individuals, populations, or suitable habitat.

Eastern Heather Vole

The eastern heather vole has not been observed during field surveys or within 10 miles of the federal lands. Approximately 2,292 acres of potentially suitable habitat (upland coniferous forest, upland mixed forest, shrubland, and cropland/grassland) exists on the federal lands (see Table 4.3.4-1), so the eastern heather vole could be present, but, if so, likely in very small numbers. The eastern heather vole was not identified on the non-federal lands by surveys or in the NHIS, but the non-federal lands contain 2,626.5 acres of habitat (see Table 4.3.4-10). According to the MDNR NHIS database, there have been eastern heather vole observations within 10 miles of the non-federal lands (Tract 3). As such, the Land Exchange Proposed Action would result in an increase to the federal estate of up to 334.9 acres of habitat.

Yellow Rail

The yellow rail was not found during surveys and was not reported in the NHIS database within 10 miles of the federal lands. As previously mentioned, small, scattered areas of its preferred habitat are present on the federal lands (35.7 acres), but not the minimum nesting patch size (54 acres) needed for the species (see Table 4.3.3-1). No yellow rails or yellow rail habitat were identified on the non-federal lands. The Land Exchange Proposed Action would not result in a net change to the species or habitat.

Laurentian Tiger Beetle

The lack of suitable habitat and any recorded observations for the Laurentian tiger beetle suggest that the species does not occur on the federal lands. However, the habitat for the Laurentian tiger beetle is present at Tract 1, in an area formerly used as a sand and gravel mine. No disturbance activities are currently planned on the non-federal lands, so this potential habitat would be preserved. According to the MDNR NHIS database, there have been Laurentian tiger beetles observed within 10 miles of the non-federal lands (Tract 4). As such, the Land Exchange Proposed Action would result in an increase of suitable habitat for this species.

Taiga Alpine

Lowland coniferous swamp is present on both the federal lands and non-federal lands, which is potential habitat for the taiga alpine. However, there would be a decrease to the federal estate of lowland coniferous swamp habitat under the Land Exchange Proposed Action. According to the MDNR NHIS database, there are no known occurrences of taiga alpine within 10 miles of the federal lands, and none were observed during surveys. There have been taiga alpine observations within 10 miles of the non-federal lands (Tract 2 and Tract 3). The Land Exchange Proposed Action would result in a decrease in potential habitat for the species but unlikely result in a change in species occurrences.

Freija's Grizzled Skipper

Grassland and shrubland is present on both the federal lands and non-federal lands, which is potential habitat for the Freija's grizzled skipper. There would be an increase to the federal estate of grassland and shrubland habitats under the Land Exchange Proposed Action. According to the MDNR NHIS database, there are no known occurrences of Freija's grizzled skipper within 10 miles of the federal lands, and none were observed during surveys. There have been Freija's grizzled skipper observations within 10 miles of the non-federal lands (Tract 2 and Tract 3). The Land Exchange Proposed Action would result in an increase in potential habitat for the species but unlikely result in a change in species occurrences.

Nabokov's Blue

Upper woodland habitat is present on both the federal lands and non-federal lands for the Nabokov's blue, though the larval host plant was not observed at either. There would be a decrease to the federal estate of upland woodland habitat under the Land Exchange Proposed Action. According to the MDNR NHIS database, there are no known occurrences within 10 miles of the federal lands, and none were observed during surveys. There have been Nabokov's blue observations within 10 miles of the non-federal lands (Tract 2, Tract 3, and Tract 5). The larval host plant, dwarf bilberry, was noted to be locally moderate to common around the observation sites. The Land Exchange Proposed Action would result in a decrease in potential habitat for the species but unlikely result in a change in species occurrences.

Quebec Emerald

The Quebec emerald dragonfly can inhabit wet meadow/sedge meadow. Approximately 36 acres of this habitat type are present on the federal lands. There has only been one documented occurrence of this species in Minnesota (Lake County in 2006), and that occurrence was not on either the federal or non-federal lands. The non-federal lands do not contain any sedge/wet meadow wetlands. The Land Exchange Proposed Action would result in a decrease of potential habitat used by this species on the federal estate.

Trumpeter Swan

Trumpeter swans were observed on Tract 1 during surveys in 2009. A pair of adults with young was seen on Little Rice Lake. The species has not been observed on the federal lands. According to the MDNR NHIS database, there have been trumpeter swan observations within 10 miles of the non-federal lands (Tract 1, Tract 2, and Tract 3). Because the species has been observed on the non-federal lands and not on the federal lands, the Land Exchange Proposed Action would result in an increase of the occurrence of this listed species within the federal estate.

5.3.5.2.3 Species of Greatest Conservation Need

Sections 4.3.5.1.1 and 4.3.5.2 discuss the SGCN in the context of their habitat. The federal lands include a wide variety of habitat types, grouped into key habitat types and MIH types (see Table 5.3.5-7).

Some acreage of some key habitat types, MIH types, and cover types within the federal estate would increase through the Land Exchange Proposed Action, while others would decrease. The key habitat types that would increase or decrease under the Land Exchange Proposed Action are

listed in Table 5.3.5-7. Species dependent on these habitat types are listed by ecological subsection in Tables 4.3.5-1 through 4.3.5-5.

Table 5.3.5-7 Increase or Decrease of Habitat Types on the Federal Estate Resulting from the Land Exchange Proposed Action

Key Habitat Type and Management Indicator Habitat	Non-Federal Lands ^{1,2}						
	Federal Lands Acres	Tract 2 –				Tract 5 – McFarland Lake Lands Acres	Net Increase or (Decrease) Acres
		Tract 1 – Hay Lake Lands Acres	Lake County Lands Acres	Tract 3 – Wolf Lands Acres	Tract 4 – Hunting Club Lands Acres		
Mature Upland Forest, Continuous Upland/Lowland Forest (MIH1-13)	5,719.7	2,978.8	337.2	1,479.4	105.7	30.6	(788.0)
Open Ground, Bare Soils (no MIH)	63.8	0.0	0.0	0.0	0.0	0.0	(63.8)
Grassland and Brushland, Early Successional Forest (no MIH)	651.8	1,696.3	38.9	96.5	45.0	0.0	1,224.9
Aquatic Environments (MIH 14)	60.1	251.1	5.8	0.0	9.6	0.2	206.6
Total	6,495.4	4,926.2	381.9	1,575.9	160.3	30.8	579.7

Note:

¹ According to non-federal land cover type summary tables (see Tables 4.3.4-1, 4.3.4-11, 4.3.4-13-20).

² Total acres may be more or less than presented due to rounding.

The Land Exchange Proposed Action would result in a decrease of 788.0 acres of forest habitat and 63.8 acres of open ground/bare soil to the federal estate. In addition, the Land Exchange Proposed Action would result in an increase of 1,224.9 acres of grassland/brushland and 206.6 acres of aquatic environment to the federal estate. Overall, the Land Exchange Proposed Action would result in an increase of up to 579.7 acres of habitat to the federal estate, though there would be a decrease of forest and open ground habitat. As such, forest-dependent species are more likely to be affected through habitat decrease by the Land Exchange Proposed Action. Grassland and brushland species (mostly bird species and one species of insect) would have more habitat available under the Land Exchange Proposed Action, as would species dependent on aquatic environments (bird species, reptile/amphibian species, and insect species). Overall, the Land Exchange Proposed Action would result in an increase of SGCN habitat to the federal estate.

5.3.5.2.4 Regional Forester Sensitive Species

A Biological Evaluation has been prepared that contains further information about RFSS. The Biological Evaluation is included in Appendix D. Similar to the Biological Assessment, the organization of the methodologies and discussion in the Biological Evaluation may be different

from the FEIS. The Biological Evaluation also contains determinations of effect for RFSS species.

The USFS determined that the Land Exchange Proposed Action and Land Exchange Alternative B may affect individuals but are not likely to cause a trend to federal listing or loss of viability for 18 RFSS terrestrial wildlife species on the Superior National Forest.

Of the 18 terrestrial RFSS on the 2011 list for the Superior National Forest, the gray wolf, eastern heather vole, northern long-eared bat, little brown bat, eastern pipistrelle, northern goshawk, boreal owl, wood turtle, taiga alpine, Freija's grizzled skipper, Nabokov's blue, and Quebec emerald dragonfly are discussed above as federally or state-listed species. Three additional RFSS (the olive-sided flycatcher, bay-breasted warbler, and Connecticut warbler) are included as SGCN and are also discussed above. The three remaining RFSS species are discussed below. Effects on the RFSS are described in more detail in the Biological Evaluation.

Bald Eagle

As discussed in Section 5.2.5.2.2, eagles may utilize the area around the federal lands. The federal lands are located between the Embarrass and Partridge rivers, which eagles may use for foraging. Mud Lake may also be used for foraging. The nearest known nesting sites are more than 2 miles (5.8 miles south-southwest of the federal lands) from the federal lands and optimal habitat for nesting is not present. Eagles may utilize Mud Lake for nesting, though they tend to utilize larger lakes for nesting. Though optimal nesting and foraging habitat are not present in the federal lands, eagles may still utilize these areas.

Eagle habitat is present on several of the non-federal lands. Though they are smaller waterbodies than are optimal for eagles, Tract 1 includes the Pike River, Hay Lake, and Rice Lake. Tracts 2 and 3 are located near large lakes such as Pine and Greenwood. Tract 5 borders McFarland Lake, which is connected to other lakes within the BWCAW. With the exception of Tract 1, these lands are also further from developed mining areas and disturbances are less likely than on the federal lands. Overall, the Land Exchange Proposed Action would result in an increase (to the federal estate) of the number of occurrences and habitat availability for the bald eagle.

Great Gray Owl

Though not observed during call surveys, the great gray owl may be occasionally present on the federal lands. Because owl calling surveys (ENSR 2005) found no great gray owls, populations in the area are likely small and/or occasional. No observations of great gray owls have been made on the non-federal lands. However, because the species utilizes forested habitat and the Land Exchange Proposed Action would result in a decrease of 788.0 acres of forested habitat, the Land Exchange Proposed Action would result in a decrease of this species' habitat on the federal estate.

Three-Toed Woodpecker

A three-toed woodpecker was identified on the federal lands during surveys in 2000 and was observed on the parcel again in 2007. Area populations are expected to be low, and these habitat specialists require standing dead or dying trees where they can forage for bark beetles. The species has not been observed on the non-federal lands. As such, the Land Exchange Proposed Action would result in a decrease of this species' occurrence. Since the Land Exchange Proposed

Action would result in a decrease of approximately 788.0 acres of forest, the Land Exchange Proposed Action would also result in a habitat decrease for this species on the federal estate.

Other factors, such as lower disturbance levels and increase of contiguous habitat, would potentially increase RFSS utilization of the non-federal lands. The federal lands contain two stands of contiguous forest habitat greater than 300 acres (340.6 acres and 1,352.3 acres) while the non-federal lands include one forest stand greater than 300 acres (598.2 acres – Tract 3, Wolf Lands 2). The Land Exchange Proposed Action would result in a net decrease of 1,094.7 acres of contiguous habitat stands greater than 300 acres to the federal estate.

5.3.5.2.5 Other Wildlife Species

Other regionally common wildlife species, such as ravens, grouse, beaver, wolves, black bear, white-tailed deer, fox, marten, and snowshoe hare, have been observed on both the federal and non-federal lands. Effects on wildlife species important to the Bands are discussed in Section 5.2.9 on a connected ecosystems level. Similar to SGCN, habitat for some other species of wildlife would increase via the Land Exchange Proposed Action while habitat would decrease for others. As previously discussed, forested habitat would decrease via the Land Exchange Proposed Action, but grassland/shrubland habitat and aquatic habitat would increase. Grassland and brushland species would have more habitat available under the Land Exchange Proposed Action, as would species dependent on aquatic environments. The Land Exchange Proposed Action would result in 579.7 additional acres of wildlife habitat to the federal estate.

Game species such as white-tailed deer and black bear are of significant concern to the Bands. As mentioned above, forested habitat on the federal estate would decrease under the Land Exchange Proposed Action, but grassland and brushland and aquatic habitat would increase. The Land Exchange Proposed Action would result in increased hunting opportunities on the federal estate, as the non-federal lands would become available for use while the federal lands, which currently have limited access, would become private.

5.3.5.3 Land Exchange Alternative B

Under the Land Exchange Alternative B, a smaller federal parcel would be exchanged for only one non-federal parcel, Tract 1. The effects that would result from this alternative are similar to those of the Land Exchange Proposed Action.

5.3.5.3.1 Federally Listed Species

Canada Lynx

As shown in Table 5.3.5-3, the smaller federal parcel includes 4,697.2 acres of suitable general habitat for lynx. Tract 1 has a total of 4,675.1 acres of habitat potentially suitable for the Canada lynx, which would result in a decrease of 22.1 acres to the federal estate. The Land Exchange Alternative B would also result in a decrease of 192.9 acres of denning habitat. Snowshoe hare habitat would increase by 51.6 acres, but there would also be an increase of 195.7 acres of unsuitable lynx habitat to the federal estate under the Land Exchange Alternative B.

The smaller federal parcel does not contain any established snow packed trails (such as snowmobile trails) but is crossed by 6.9 miles of road surface. Tract 1 is crossed by 2.2 miles of roads and no established snow trails. Since lynx use snow packed trails and roads as travel

corridors, the Land Exchange Alternative B would result in a decrease to the federal estate of 4.7 miles of road use for lynx.

Land ownership under the Land Exchange Alternative B would be similar to the Land Exchange Proposed Action, but the smaller federal parcel would be bordered to the west by USFS-managed federal lands. Tract 1 is bordered by federal lands to the north, west, and partially east, but the area is generally surrounded by private lands and developed areas. Habitat connectivity to Tract 1 is marginal. The Land Exchange Alternative B is likely to result in limited habitat connectivity overall. Similar to the Land Exchange Proposed Action, the smaller federal parcel and non-federal lands are located within lynx critical habitat and would remain so regardless of ownership; the Land Exchange Alternative B would not result in a change to lynx critical habitat. As shown in Table 5.3.5-5, the Land Exchange Alternative B would result in the decrease of 4,753 acres of land within an LAU because the federal parcel is within an LAU, but the Tract 1 lands are not.

The Land Exchange Alternative B would have mixed habitat effects for the Canada lynx. It would result in a decrease of overall suitable habitat for lynx and denning habitat, but would result in an increase of suitable snowshoe hare habitat. It would also result in a decrease of federal lands within designated LAUs. Critical lynx habitat would not change regardless of ownership. As such, the Land Exchange Alternative B is not likely to have either a net increase or decrease on Canada lynx on the federal estate.

Gray Wolf

Gray wolves have been observed on both the smaller federal parcel and on Tract 1. Approximately 271 acres of forage habitat is present on the smaller federal parcel (young age class, see Table 5.3.4-4) and 533.8 acres are present on Tract 1. There are 3,912.9 acres of cover habitat on the smaller federal parcel (immature and mature age classes) and 3,720.0 acres on Tract 1. This would result in an increase of 262.8 acres of forage habitat but also in a decrease of 192.9 acres of cover habitat on the federal estate under Land Exchange Alternative B.

Northern Long-Eared Bat

Potential summer roosting and foraging habitat for the northern long-eared bat is present and individuals have been observed on the smaller federal parcel, though no hibernacula have been observed. Bats were observed, though not identified to species, on Tract 1 during field studies in 2009. The Land Exchange Alternative B would result in a net decrease of mature forest habitat to the federal estate, but an increase in grassland/brushland, which constitutes a decrease in potential summer roosting habitat but increase in foraging habitat within the federal estate.

5.3.5.3.2 State-listed Species

Wood Turtle

No wood turtles or optimal wood turtle habitat were identified on Tract 1 or the smaller federal parcel. According to the MDNR NHIS database, there have been wood turtles observed within 10 miles of the non-federal lands (Tract 1). As such, the Land Exchange Alternative B would not result in an increase or decrease of habitat for the species on the federal estate.

Eastern Heather Vole

The eastern heather vole has not been observed during field surveys within 10 miles of the federal lands. There are 1,261.6 acres of potentially suitable habitat on the smaller federal parcel (see Table 4.3.4-6). Eastern heather voles were not identified on the non-federal lands by surveys or in the NHIS, but Tract 1 contains 2,133.6 acres of habitat, which would result in an increase of 872.0 acres of habitat for the eastern heather vole on the federal estate. As such, the Land Exchange Alternative B would result in an increase of habitat for this species.

Yellow Rail

The yellow rail was not found during surveys and was not reported in the NHIS database within 10 miles of the federal lands. As previously mentioned, small, scattered areas of its preferred habitat are present on the federal lands (34.9 acres), but not the minimum nesting patch size (54 acres) needed for the species. Similar to the Land Exchange Prosed Action, the Land Exchange Alternative B would not result in a net change to the species or its habitat on the federal estate.

Laurentian Tiger Beetle

Similar to the Land Exchange Proposed Action, the lack of suitable habitat and any recorded observations for the Laurentian tiger beetle suggest that the species does not occur on the smaller federal parcel. However, habitat for the Laurentian tiger beetle is present on Tract 1, in an area formerly used as a sand and gravel mine. No disturbance activities are currently planned on Tract 1, so this potential habitat would be preserved. As such, the Land Exchange Alternative B, similar to the Land Exchange Proposed Action, would result in an increase of suitable habitat for the species on the federal estate.

Taiga Alpine

There is potential habitat present for the taiga alpine on both the Alternative B: Smaller Federal Parcel and Tract 1 lands. Under the Land Exchange Alternative B, there would be a decrease to the federal estate of lowland coniferous swamp habitat, and therefore a decrease in potential habitat for the species, but it is unlikely this would result in a change in species occurrences.

Freija's Grizzled Skipper

There is potential habitat present for the Freija's grizzled skipper on both the Alternative B: Smaller Federal Parcel and Tract 1 lands. Under the Land Exchange Alternative B, there would be an increase to the federal estate of grassland and shrubland habitats, and therefore an increase in potential habitat for the species, but it is unlikely this would result in a change in species occurrences.

Nabokov's Blue

There is potential habitat present for the Nabokov's blue on both the Alternative B: Smaller Federal Parcel and Tract 1 lands, though the larval host plant was not observed at either. Under the Land Exchange Alternative B there would be a decrease to the federal estate of upland woodland habitat and a decrease in potential habitat for the species; but it is unlikely this would result in a change in species occurrences.

Quebec Emerald

The Quebec emerald dragonfly has not been identified on the smaller federal parcel, as there has only been one documented occurrence of this species in Minnesota in Lake County in 2006 (Minnesota Odonata Survey Project 2012). Tract 1 does not contain any sedge/wet meadow wetlands, and so the Land Exchange Alternative B would result in a decrease of potential habitat used by this species on the federal estate.

Trumpeter Swan

Trumpeter swans were observed on Tract 1 during surveys in 2009. A pair of adults with young was seen on Little Rice Lake. The species has not been observed on the smaller federal parcel. Similar to the Land Exchange Proposed Action, because the species has been observed on Tract 1 but not on the smaller federal parcel, the Land Exchange Alternative B would result in an increase of the occurrence of this listed species within the federal estate.

5.3.5.3.3 Species of Greatest Conservation Need

Like the Land Exchange Proposed Action, the SGCN for the Land Exchange Alternative B are discussed in the context of their habitat. The smaller federal parcel also includes a wide variety of habitat types, grouped into key habitat types and MIH types (see Table 5.3.5-8).

Similar to the Land Exchange Proposed Action, the Land Exchange Alternative B would result in a decrease of forest habitat (1,279.3 acres) and open ground/bare soil (29.1 acres) on the federal estate. The Land Exchange Proposed Action, however, would result in an increase of grassland/brushland (1,257.2 acres) and aquatic environments (224.8 acres) on the federal estate. Overall, the Land Exchange Proposed Action would result in an increase of up to 173.6 acres of habitat to the federal estate, though there would be a decrease of forest and open ground habitat. As such, forest-dependent species are more likely to be affected through habitat decrease under the Land Exchange Alternative B. Grassland and brushland species (mostly bird species and one species of insect) would have more habitat available under the Land Exchange Alternative B, as would species dependent on aquatic environments (bird species, reptile/amphibian species, and insect species). Overall, the Land Exchange Alternative B would result in an increase of SGCN habitat to the federal estate.

Table 5.3.5-8 Increase or Decrease of Habitat Types on the Federal Estate Resulting from Land Exchange Alternative B

Key Habitat Type and Management Indicator Habitat	Smaller Federal Parcel (Acres)	Non-Federal Land Tract 1 (Acres)	Net Increase or (Decrease) (Acres)
Mature Upland Forest, Continuous			
Upland/Lowland Forest (MIH1-13)	4,258.1	2,978.8	(1,279.3)
Open Ground, Bare Soils (no MIH)	29.1	0.0	(29.1)
Grassland and Brushland, Early Successional Forest (no MIH)	439.1	1,696.3	1,257.2
Aquatic Environments (MIH 14)	26.3	251.1	224.8
Total¹	4,752.6	4,926.2	173.6

Note:

¹ Total acres may be more or less than presented due to rounding.

5.3.5.3.4 Regional Forester Sensitive Species

Bald Eagle

As under the Land Exchange Proposed Action, the smaller federal parcel and surrounding areas may be utilized by bald eagles. Similar to the Land Exchange Proposed Action, the smaller federal parcel is also located between the Embarrass and Partridge rivers, which eagles may use for foraging. However, the smaller federal parcel excludes a portion of Mud Lake. The nearest known nesting sites are greater than 2 miles (5.8 miles south-southwest of the smaller federal parcel) from the federal lands and optimal habitat for nesting is not present.

Tract 1 contains waterbodies (Pike River, Hay Lake, and Rice Lake) and large trees, which eagles may use for nesting, though no nests have been observed. The nearest known eagle nest is approximately 4 miles southwest of the parcel.

Great Gray Owl

Though not observed during call surveys, the great gray owl may be occasionally present on the smaller federal parcel, as an individual was observed along Dunka Road south of the Mine Site in 2009. No observations of great gray owls have been made on Tract 1. However, because the species utilizes forested habitat and the Land Exchange Alternative B would result in a decrease of 1,279.3 acres of forested habitat, the Land Exchange Alternative B would result in a decrease of this species' habitat on the federal estate.

Three-Toed Woodpecker

Three-toed woodpeckers were observed on or near the smaller federal parcel in 2000 and again in 2007. Area populations are expected to be low, and the species has not been observed on Tract 1. As such, the Land Exchange Alternative B would result in the decrease of this species' occurrence. Since the Land Exchange Alternative B would result in a decrease of 1,279.3 acres of forest, this would result in a habitat decrease for this species on the federal estate.

Other factors, such as lower disturbance levels and increase of contiguous habitat, would potentially increase RFSS utilization of Tract 1 lands. The smaller federal parcel contains two stands of contiguous forest habitat greater than 300 acres (340.6 and 926.1 acres) while there are no stands greater than 300 acres on Tract 1.

5.3.5.3.5 Other Wildlife Species

Similar to the Land Exchange Proposed Action, forested habitat within the federal estate would decrease under the Land Exchange Alternative B, but grassland/shrubland habitat and aquatic habitat would be increased. Grassland and brushland species would have more habitat available under the Land Exchange Alternative B, as would species dependent on aquatic environments. The Land Exchange Alternative B would result in 173.6 additional acres of wildlife habitat on the federal estate.

5.3.5.4 Land Exchange No Action Alternative

Under the Land Exchange No Action Alternative, the current federal lands would remain in federal ownership and would continue to be managed under the General Forest – Longer Rotation Management Area and the General Forest Management Area. Wildlife would be directly affected by logging, mineral exploration, vehicle traffic, natural disturbances, and thinning activities, which would occur as planned by the USFS, and would be indirectly affected by changes in habitat caused by forest management. However, these activities would affect wildlife to a lesser degree than under the Land Exchange Proposed Action. Section 5.2.4.3.1 provides further discussion of the effects on management of cover types and habitat on the federal lands. Under the Land Exchange No Action Alternative, the USFS has an ongoing responsibility for managing wildlife resources on Superior National Forest lands in accordance with the Forest Plan (USFS 2004b). The Land Exchange No Action Alternative would not change the Forest Service's responsibility for managing wildlife resources and would result in no change in anticipated effects on existing wildlife.

Under the Land Exchange No Action Alternative, the non-federal lands would not go into USFS ownership, and land use would be determined by the private land owners. Effects on wildlife species are difficult to predict given the uncertainty of future potential land use. Lands may be developed, resulting in potential effects on individuals and local populations, habitat decrease, and effects on wildlife travel corridors.

5.3.6 Aquatic Species

This section describes the environmental consequences of the Land Exchange alternatives on aquatic biota, using comparisons of the existing conditions presented in Sections 4.2.6 and 4.3.6 to conditions after the Land Exchange alternatives in terms of net increase or decrease in aquatic biological resources for the federal and non-federal lands.

The Land Exchange Proposed Action would result in a net increase to the federal estate of surface waters (MIH 14), including 99.1 acres of lakes, 3.8 miles of rivers, and 8.1 miles of third-order streams. It would also result in a decrease to the federal estate of 0.3 miles of first-order streams and 4.0 miles of second-order streams. The Land Exchange Proposed Action would result in an increase in watershed riparian connectivity and aquatic connectivity for the federal estate. Based on available data, the Land Exchange Proposed Action would potentially result in an increase of nine additional fish species to the federal estate, while the macroinvertebrate assemblage would be similar. The Land Exchange Proposed Action could result in an increase to the federal estate of six new potential SGCN species, based on ecoregion data.

Land Exchange Alternative B would result in a net increase to the federal estate of surface waters (MIH 14), including 120.7 acres of lakes, 2.8 miles of rivers, and 8.1 miles of third-order streams. Additionally, it would result in a decrease to the federal estate of 1.3 miles of first-order streams and 4.0 miles of second-order streams, and an increase to the federal estate of. Land Exchange Alternative B would result in an increase in watershed riparian connectivity and aquatic connectivity for the federal estate. Based on available data, Land Exchange Alternative B would potentially result in a decrease to the federal estate of four fish species, while the macroinvertebrate assemblage would likely be similar. Land Exchange Alternative B would result in no net change of SGCN species, based on ecoregion data.

The Land Exchange No Action Alternative would not result in any increase or decrease of aquatic habitats or SGCN species to the federal estate.

Rulemaking was conducted with the intent to update the list of ETSC species (*Minnesota Rules*, parts 6134.0100 to 6134.0400), with new listings becoming effective on August 19, 2013 (MDNR 2013h). The FEIS considers any new listings, or changes in the previous listings, associated with the updated list. The FEIS also considers any federal listing changes. A Biological Evaluation has been prepared that contains further information about RFSS species. The Biological Evaluation is included in Appendix D.

5.3.6.1 Methodology and Evaluation Criteria

The criteria used to describe the direct and indirect effects of the Land Exchange alternatives focused on the ecological integrity of the aquatic systems present at the federal lands and non-federal lands where physical, chemical, and biological characteristics that are important to biotic quality were considered. The spatial and temporal area of analysis for aquatic resources included the federal and non-federal lands that are proposed for the exchange based on current conditions.

The methodology used for analysis of the Land Exchange alternatives included review and evaluation of available literature, aerial photography review, and GIS analysis of all surface waters and aquatic species habitat present within the Land Exchange areas. Both quantitative and

qualitative analyses were used. The analysis of the aquatic resources affected by the Land Exchange alternatives was guided by evaluation criteria that were developed by the USFS and other Co-lead Agencies as follows:

- Change in the amount of Superior National Forest MIHs (MIH 14 [aquatic habitat]) available for species on the federal and non-federal lands;
- Changes in the length of stream segments;
- Changes in the area of lake or deepwater wetland;
- Qualitative determination of community habitat and ecological value;
- Qualitative assessment of the aquatic connectivity (network created by streams, rivers, and lakes as they flow into one another) and the potential for barriers to fish passage; and
- Net change in aquatic species.

5.3.6.2 Land Exchange Proposed Action

5.3.6.2.1 Surface Water Features (MIH 14)

Comparing the footprints of the surface water features present within the federal and non-federal lands provides a direct assessment of the increase or decrease to the federal estate in aquatic environments that support aquatic biota and associated habitats. This comparison was made by analyzing the linear shoreline frontage and frontage index of the surface water features within the federal and non-federal lands, where the frontage index indicates the linear ft of lake and shoreline frontage per acre of land.

The Land Exchange Proposed Action would result in a net increase of surface water resources to the federal estate (see Table 5.3.6-1). A net increase of 99.1 acres of lake and 3.8 miles of rivers would be added to the federal estate from the Land Exchange Proposed Action. For both lakes and streams, the frontage index would increase substantially by 34.0 shoreline/acre units as a result of the exchange.

Table 5.3.6-1 Federal and Non-federal Land Surface Water Comparisons

Parcel	Lake			Rivers/Creeks/Streams		
	Acres	Frontage (ft)	Frontage Index (shoreline/acre)	Miles	Frontage (linear ft) ¹	Frontage Index (shoreline/acre) ²
Lands Conveyed						
Federal Lands	30.5	4,550.0	0.7	5.3	55,968.0	8.6
Lands Acquired						
Tract 1 – Hay Lake	129.6	16,424.0	3.5	8.1	72,864.0	15.3
Tract 2 – Lake County	0.0	0.0	0.0	0.0	0.0	0.0
Tract 3 – Wolf Lands						
Wolf Lands 1	0.0	0.0	0.0	0.0	0.0	0.0
Wolf Lands 2	0.0	0.0	0.0	0.0	0.0	0.0
Wolf Lands 3	0.0	0.0	0.0	0.1	1,056.0	3.9
Wolf Lands 4	0.0	0.0	0.0	0.9	9,504.0	23.5
Tract 4 – Hunting Club	0.0	0.0	0.0	0.0	0.0	0.0
Tract 5 – McFarland Lake	0.0	990.0	32.1	0.0	0.0	0.0
Total Non-federal lands	129.6	17,414.0	35.6	9.1	83,424.0	42.6
Net Change						
Net Increase/(Decrease)	99.1	12,864.0	34.9	3.8	27,456.0	34.0

Notes:

Surface water shoreline distance calculated by GIS analysis.

¹ Includes shoreline distance on both sides of streams.

² Frontage Index calculated by dividing total acres of parcel by total shoreline within parcel.

5.3.6.2.2 Differences of Strahler Stream Orders and Habitat

For the purposes of this FEIS, the Strahler Order (USEPA 2011a) is used to describe the hierarchical ordering of streams, where a first-order stream describes a headwater type stream with no branching. Where two first-order streams meet, they become larger second-order streams and where two second-order streams meet, they become larger third-order streams, etc. A quantitative comparison of the Strahler Stream Order indicates the Land Exchange Proposed Action would result in a decrease of 0.3 miles of first-order headwater streams and 4.0 miles of second-order streams, and an increase in 8.1 miles of third-order streams to the federal estate (see Table 5.3.6-2).

The net increase of third-order streams and decrease in second-order streams would likely add more habitat diversity to the Superior National Forest since, generally, stream habitat diversity increases with higher-order streams. No significant habitat changes would likely occur associated with the slight decreases in first-order, headwater streams acquired as a result of the Land Exchange Proposed Action; however, the net reduction to the Superior National Forest of 0.3 mile of first order streams may result in slightly less habitat available for headwater stream dependent species.

Table 5.3.6-2 Increase or Decrease of Stream Orders from the Land Exchange Proposed Action

Parcel (Stream)	Stream Distance (miles)		
	1 st Order	2 nd Order	3 rd Order
Lands Conveyed			
Federal Lands (Yelp Creek and Partridge River)	1.3	4.0	0.0
Lands Acquired			
Tract 1 – Hay Lake (Pike River)	0.0	0.0	8.1
Tract 2 – Lake County	0.0	0.0	0.0
Tract 3 – Wolf Lands			
Wolf Lands 1	0.0	0.0	0.0
Wolf Lands 2	0.0	0.0	0.0
Wolf Lands 3 (Coyote Creek)	0.1	0.0	0.0
Wolf Lands 4 (Coyote Creek)	0.9	0.0	0.0
Tract 4 – Hunting Club	0.0	0.0	0.0
Tract 5 – McFarland Lake	0.0	0.0	0.0
Total Non-federal Lands	1.0	0.0	8.1
Net Increase/(Decrease)	(0.3)	(4.0)	8.1

Note:

Surface water shoreline distance calculated by GIS analysis.

5.3.6.2.3 Watershed Level Riparian and Aquatic Connectivity

Riparian Connectivity

Intact riparian areas are an important factor contributing to diverse and productive aquatic ecosystems and function to maintain available water quality and physical habitat. The streams present on the federal and non-federal lands (Partridge River, Pike River, and Coyote Creek) are each part of a network of streams, creeks, and rivers that makes up a larger watershed. The connections between these surface water features are affected by the vegetated, undisturbed riparian edges bordering these water bodies. A comparison of the watersheds using the RCI is presented in Table 5.3.6-3. The index was developed from GIS analysis of vegetative cover along riparian areas where agriculture and land development have affected natural riparian vegetative cover.

The Land Exchange Proposed Action would result in a slight increase in watershed riparian connectivity, which indicates that the streams on both the federal and non-federal lands are located within watersheds with existing high-quality riparian connectivity.

Table 5.3.6-3 Watershed Riparian Connectivity Index Comparison

Surface Water Lands Conveyed	Tract	Watershed	Percent Agriculture in Riparian Zone	Percent Development in Riparian Zone	RCI Score ¹
Partridge River/Yelp Creek	Federal Lands	St. Louis	0	5	95
Lands Acquired					
Pike River	1 - Hay Lake	Vermillion	0	1	99
Coyote Creek	3 - Wolf Lands 3 and 4	Rainy River-Headwaters	0	0	100
Net Increase/(Decrease)²			0	(4)	4.5

Source: Adopted from MDNR 2015a.

Notes:

¹ RCI score calculated with MDNR formula using Percent Agriculture and Percent Development in Riparian Zone; scale is from 0 to 100 where 100 indicates excellent riparian conductivity.

² Non-federal lands RCI score averaged to determine net increase/decrease.

Aquatic Connectivity

Structures within streams, such as dams, bridges, and culverts reduce the longitudinal and lateral connectivity of the watershed. These structures can degrade the aquatic habitat in the watershed by slowing stream flow, increasing sedimentation, incising stream channels, changing the depth, and disconnecting portions of streams from the floodplain. The ACI was developed from GIS analysis of number of structures per stream mile for each watershed, and the watershed ACI scores were used to provide a comparison of each watershed.

The Land Exchange Proposed Action would result in the Superior National Forest acquiring streams located in watersheds with better aquatic connectivity values (see Table 5.3.6-4).

Table 5.3.6-4 Watershed Aquatic Connectivity Index Comparison

Surface Water Lands Conveyed	Tract	Watershed	Aquatic: Bridges and Culverts (miles stream/# structures)	Aquatic: Dams (miles stream/# structures)	ACI Score ¹
Partridge River/Yelp Creek	Federal Lands	St. Louis	15	6	11
Lands Acquired					
Pike River	1 - Hay Lake	Vermillion	41	11	26
Coyote Creek	3 - Wolf Lands 3 and 4	Rainy River-Headwaters	89	19	54
Net Increase/(Decrease)²			50	9	29

Source: Adopted from MDNR 2015b.

Notes:

¹ ACI score calculated by dividing total miles of streams and ditches per watershed by total number of culverts, bridges, and dams; scale is from 0 to 100 where 100 indicates free flowing streams (no structures) and 0 indicates one structure for every 20 miles of flowing water.

² Non-federal lands averaged to determine net increase/decrease.

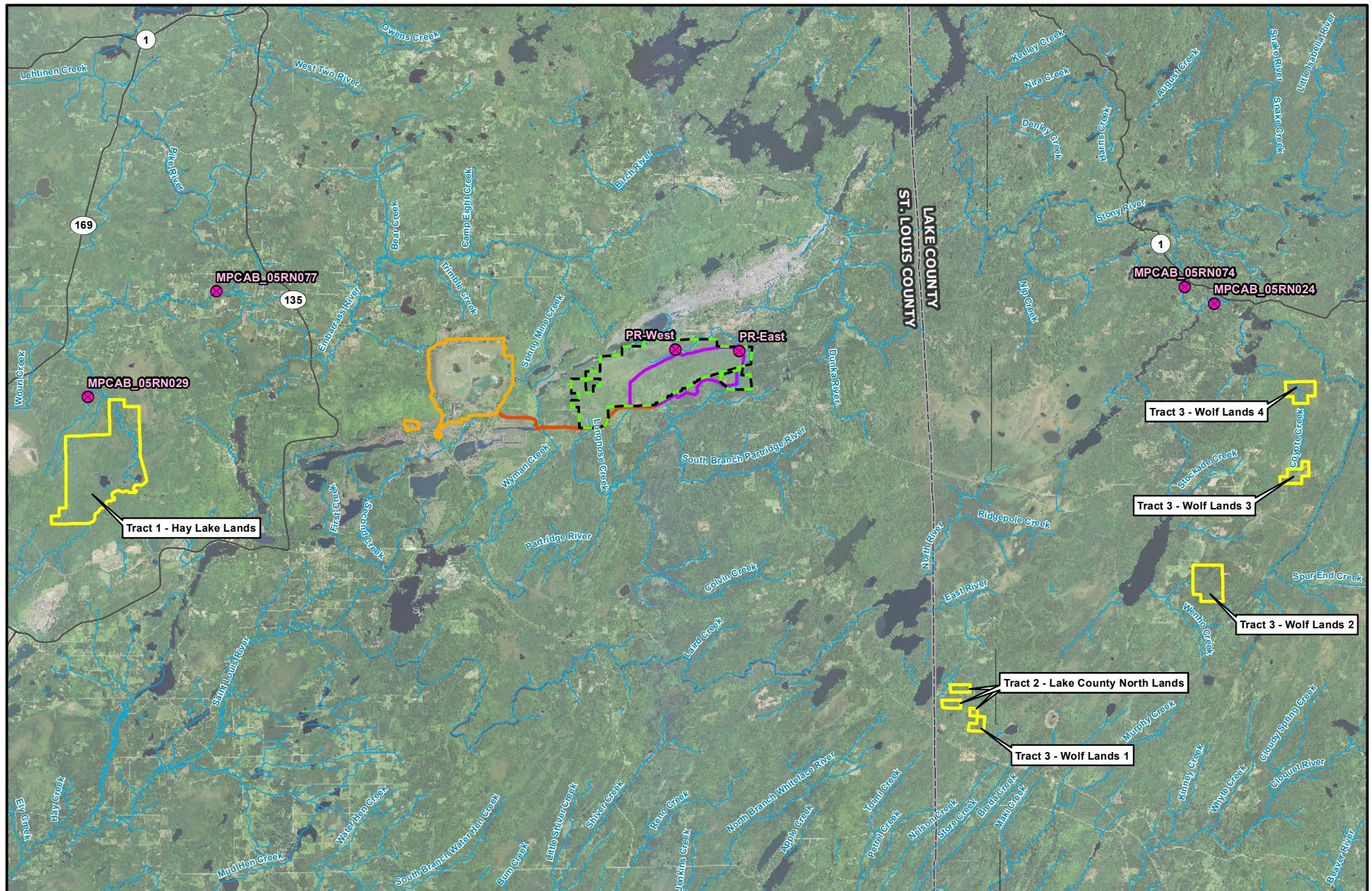
5.3.6.2.4 Aquatic Species Assemblages

A complete quantitative comparison of the net increase or decrease of aquatic species cannot be made for the purposes of the Land Exchange Proposed Action due to the absence of complete baseline information. Only the federal lands had aquatic biota and habitat sampling sites within the parcel boundaries. A qualitative comparison can be made for species located at the two sites within the federal parcels and the four sites near the non-federal parcels (see Section 4.2.6). The exception to this statement includes the differences between the Coyote Creek headwater stream habitat and the Stony River sampling sites chosen to qualitatively represent Tract 3, which are summarized below.

Fish Assemblages

Two survey sites were analyzed within the vicinity of the federal lands while four survey sites were analyzed among the non-federal lands (in the vicinity of Pike River and Coyote Creek; see Figure 5.3.6-1). The federal lands and the survey sites within the vicinity of the non-federal lands had 11 species in common (see Table 5.3.6-5). The Land Exchange Proposed Action would result in a potential increase to the federal estate of 12 additional species, including two pollution-intolerant species and two pollution-tolerant species (see Tables 5.3.6-5 and 5.3.6-7). There would be a potential decrease to the federal estate of one different pollution-intolerant species and one different pollution-tolerant species. Given the fact that the survey sites used for non-federal lands may not be representative, it is possible that some species are more or less prevalent than is noted here.

The fish assemblages located at each survey site indicate that the Land Exchange Proposed Action potentially would result in minimal change to the fish assemblages for the streams the Superior National Forest would acquire. Additionally, the dominant fish species present at each site (see Table 5.3.6-6) indicate that the stream characteristics were consistent with slower moving, glide pool features with the exception of the segment on the Stony River where the MCAB_05RN024 survey site was located. Longnose dace dominate the fish community at the site, which indicate riffle-run habitats are likely present as described in Section 4.2.6. Note that Coyote Creek, within Tract 3, likely exhibits first order, headwater stream characteristics and if riffle-run habitat is present there, it would likely be smaller and support a less diverse fish community than the Stony River sampling site.



- Study Site
 - Federal Lands
 - Non-federal Lands
 - Mine Site
 - Plant Site
 - W Transportation and Utility Corridor
 - ~ Streams/Rivers
 - Existing Road



The logo of the US Army Corps of Engineers, featuring a stylized castle tower inside a red square border.



0 1.5 3 6 Miles

Figure 5.3.6-1
Federal and Non-federal Lands Aquatic Study Area
NorthMet Mining Project and Land Exchange FEIS
Minnesota

November 2015

-Page Intentionally Left Blank-

Table 5.3.6-5 Potential Increase or Decrease of Stream Fish Assemblage for the Land Exchange Proposed Action

Species	Common Name	Tolerance Designation ¹	Federal Land Parcel	Non-federal Land Parcels (study areas within vicinity of Tract 1 and Tract 3 - Wolf Lands 3 and 4)
<i>Catostomus commersonii</i>	White sucker	Tolerant	X	X
<i>Luxilus cornutus</i>	Common shiner	Intermediate	X	X
<i>Notemigonus crysoleucas</i>	Golden shiner	Tolerant		X
<i>Notropis heterolepis</i>	Blacknose shiner	Intolerant		X
<i>Notropis hudsonius</i>	Spottail shiner	Intermediate		X
<i>Notropis volucellus</i>	Mimic shiner	Intolerant		X
<i>Etheostoma nigrum</i>	Johnny darter	Intermediate	X	X
<i>Perca flavescens</i>	Yellow perch	Intermediate		X
<i>Sander vitreus</i>	Walleye	Intermediate		X
<i>Percina caprodes</i>	Logperch	Intermediate		X
<i>Lota lota</i>	Burbot	Intermediate	X	X
<i>Ambloplites rupestris</i>	Rock bass	Intermediate		X
<i>Micropterus dolomieu</i>	Smallmouth bass	Intermediate		X
<i>Esox lucius</i>	Northern pike	Intermediate	X	X
<i>Phoxinus eos</i>	Northern redbelly dace	Tolerant	X	
<i>Culaea inconstans</i>	Brook stickleback	Intermediate	X	X
<i>Phoxinus neogaeus</i>	Finescale dace	Intermediate		X
<i>Rhinichthys atratulus</i>	Blacknose dace	Intolerant	X	
<i>Rhinichthys cataractae</i>	Longnose dace	Intolerant	X	X
<i>Semotilus margarita</i>	Pearl dace	Intermediate	X	
<i>Noturus gyrinus</i>	Tadpole madtom	Intermediate	X	X
<i>Umbrat limi</i>	Central mudminnow	Tolerant	X	X
<i>Hybognathus hankinsoni</i>	Brassy minnow	Intermediate	X	
<i>Pimephales promelas</i>	Fathead minnow	Tolerant	X	X
<i>Cottus bairdii</i>	Mottled sculpin	Intolerant	X	X
<i>Semotilus atromaculatus</i>	Creek chub	Tolerant		X
<i>Coregonus clupeaformis</i>	Lake whitefish	Intermediate		X
Total Species			15	23
# Intolerant Species			3	4
# Tolerant Species			4	5
Net Increase or Decrease Species			(8)	8
Net Increase or Decrease Intolerant Species			(1)	1
Net Increase or Decrease Tolerant Species			(1)	1

Note:

¹ Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish - Second Edition EPA 841-B-99-002 (USEPA 2012b).

Table 5.3.6-6 Dominant Fish Species Present at Study Sites

Attributes	Federal Land (within parcel)		Non-federal Land (study areas within vicinity of Tract 1)		Non-federal Land (study areas within vicinity of Tract 3 - Wolf Lands 3 and 4)	
	Study site	PR-west	PR-east	MPCAB-05RN029	MPCAB-05RN077	MPCAB-05RN024
Dominant Species	Brook stickleback	Northern redbelly dace	White sucker	White sucker	Longnose dace	Blacknose shiner

Sources: Adopted from Barr 2011b and MPCA 2011c.

Table 5.3.6-7 Increase or Decrease of Stream Fish Assemblage for the Land Exchange Proposed Action

Combined Studies Within, or Within Vicinity of, Surface Water	Tract	Total Species (#)	Pollution-Intolerant Species (#)	Pollution-Tolerant Species (#)
Lands Conveyed				
Partridge River	Federal Lands	15	3	4
Lands Acquired				
Pike River	Tract 1	11	0	4
Coyote Creek	Tract 3 - Wolf Lands 3 and 4	18	4	4
Total Non-Federal Lands		21 ¹	4	5 ²
Net Increase/(Decrease)		12 species (4) other species	1	1

Source: Adopted from Section 4.3.6.

Notes:

¹ Species would overlap between Tract 1 and Tract 3; thus, 21 species are distinct number of species for combined non-federal lands.

² Does not equal sum of non-federal lands since some species overlap or vary between Tract 1 and Tract 3.

Benthic Macroinvertebrate Assemblages

Macroinvertebrate baseline surveys completed within and in the vicinity of the federal lands ranked macroinvertebrate assemblages as fair within the second-order stretches of the Partridge River, as indicated by the HBI (see Table 5.3.6-8). The first-, third-, and fourth-order segments of the streams within the vicinity of the non-federal lands indicated macroinvertebrate assemblages ranging from good to fair. A qualitative comparison using the attributes of HBI, stream order, total families (diversity), and percent pollution-tolerant organisms indicate that the macroinvertebrate assemblages likely would remain the same under the Land Exchange Proposed Action. This qualitative comparison assumes the habitat and associated macroinvertebrate assemblages are similar in the stream segments within the non-federal lands boundaries including the third-order segment of the Pike River on Tract 1 and the first-order segments of Coyote Creek within Tract 3 (see Figure 5.3.6-1).

Table 5.3.6-8 Stream Macroinvertebrate Assemblage Comparisons for the Land Exchange Proposed Action

Attributes	Federal Parcel (within parcel)		Non-federal Land (study areas within vicinity of Tract 1)		Non-federal Land (study areas within vicinity of Tract 3- Wolf Lands 3 and 4)	
	PR-west	PR-east	MPCAB- 05RN029	MPCAB- 05RN077	MPCAB- 05RN024	MPCAB- 05RN074
Study site						
Stream order	2	2	1	4	3	4
HBI score	6.4	6.0	5.7	5.1	5.9	5.2
HBI ranking	Fair	Fair	Fair	Good	Fair	Good
Total families	11	10	11	31	23	27
Percent pollution-tolerant	8	18	3	5	10	26

Sources: Adopted from Barr 2011b and MPCA 2011c.

5.3.6.2.5 Aquatic Species of Greatest Conservation Need

The MDNR and USFS have developed the ECS for ecological mapping and landscape classification (MDNR 2011a), which defines uniform ecological features within a mapped area. The federal and non-federal lands are located in the Northern Superior Uplands Section of the Laurentian Mixed Forest Province. These lands are further divided into several subsections. The federal lands include the Laurentian and Nashwauk Uplands subsections while the non-federal lands include these two subsections and the Border Lakes subsection.

As discussed in Section 4.2.6.1.4, SGCN aquatic species are associated with these ecological subsections based on occurrence and habitat considerations. Using the approach of comparing SGCN species by subsection association only, the Land Exchange Proposed Action could result in an increase of six new potential SGCN species (see Table 5.3.6-9). Of these, the spoonhead sculpin, lake chub, and longear sunfish have the highest potential to be found near the shoreline habitat of Tract 5 (within the Border Lakes subsection).

Regardless of the potential indicated by subsection association, no SGCN species were identified within the boundaries of the federal or non-federal lands during field surveys. While habitat is present in at least some locations within these boundaries for SGCN species, the surveys performed within the vicinity of the federal lands found no SGCN aquatic species, suggesting that SGCN species are likely not present on the federal lands. Conversely, occurrences of the creek heelsplitter, an SGCN species, have been documented within the vicinity of the non-federal lands on segments of the Pike River (downstream of Tract 1) and the Stony River (downstream of Tract 3) as discussed in Section 4.3.6.2. The predominant sand substrate documented in survey areas within the vicinity of these SGCN occurrence locations and the possibility that similar substrates exist within the boundaries of Tract 1 and Tract 3 indicate the creek heelsplitter may exist within the river segments of these non-federal lands. A qualitative review of these data indicates the Land Exchange Proposed Action may result in the added presence of the creek heelsplitter.

The USFS determined that the Land Exchange Proposed Action would not affect three RFSS aquatic species on the Superior National Forest, which include lake sturgeon, nipigon cisco, and shortjaw ciscoe. In addition, the Land Exchange Proposed Action may affect individuals, but would not be likely to cause a trend to federal listing or loss of viability for the remaining six RFSS aquatic species on the Superior National Forest. Please see the Biological Evaluation listed

on the USFS website (<http://www.fs.usda.gov/goto/superior/northmet>) for more information about effects on RFSS aquatic species.

Table 5.3.6-9 Ecoregion SGCN Species Comparisons for the Land Exchange Proposed Action

SGCN Species	Common Name	Federal Land (Laurentian and Nashwauk Uplands)	Non-federal Lands (Laurentian Uplands, Nashwauk Uplands, Border Lakes)
Fish			
<i>Acipenser fulvescens</i>	Lake sturgeon		X
<i>Coregonus nigripinnis</i>	Nipigon cisco		X
<i>Coregonus zenithicus</i>	Shortjaw cisco		X
<i>Cottus ricei</i>	Spoonhead sculpin		X
<i>Couesius plumbeus</i>	Lake chub		X
<i>Ichthyomyzon fossor</i>	Brook lamprey	X	X
<i>Lepomis megalotis</i>	Longear sunfish		X
Mussels			
<i>Lasmigona compressa</i>	Creek heelsplitter	X	X
<i>Ligumia recta</i>	Black sandshell	X	X
Total species		3	9

Source: Adopted from Section 4.3.6.

5.3.6.3 Land Exchange Alternative B

5.3.6.3.1 Surface Water Features (MIH 14)

Land Exchange Alternative B would result in a net increase of lake and river surface water features to the federal estate (see Table 5.3.6-10). A total of 120.7 acres of lake and 2.8 miles of rivers would be added to the Superior National Forest under this alternative. The increase in lake and river frontage would provide a net increase to the federal estate of habitat for aquatic species (MIH 14). The frontage index would increase in the federal estate for both lakes and streams as a result of Land Exchange Alternative B.

Table 5.3.6-10 Frontage of Waterways for Land Exchange Alternative B

Parcel	Lake			Rivers/Creeks/Streams		
	Acres	Frontage (ft)	Frontage Index (shoreline/acre)	Miles	Frontage (linear ft) ¹	Frontage Index (shoreline/acre) ²
Lands Conveyed						
Land Exchange Alternative B	8.9	1,200.0	0.3	5.3	55,968.0	11.8
Lands Acquired						
Tract 1	129.6	16,424.0	3.5	8.1	72,864.0	15.3
Net Change						
Net Increase/(Decrease)	120.7	15,224.0	3.2	2.8	16,896.0	3.5

Note:

Surface water shoreline distance calculated by GIS analysis.

¹ Includes shoreline distance on both sides of streams.

² Frontage Index calculated by dividing total acres of parcel by total shoreline within parcel.

5.3.6.3.2 Differences of Strahler Stream Orders and Habitat

A quantitative comparison of the Strahler Stream Order indicates that Land Exchange Alternative B would result in a decrease of 1.3 and 4.0 miles of first- and second-order streams, respectively, and an increase of 8.1 miles of third-order streams to the federal estate (see Table 5.3.6-11).

As with the Land Exchange Proposed Action, the net increase of third-order streams and decrease in first- and second-order streams would likely add more habitat diversity to the Superior National Forest. The net decrease to the federal estate of first-order streams would slightly reduce the amount of available spawning habitat for some aquatic species as headwater streams provide specialized spawning habitat for some species.

Table 5.3.6-11 Increase or Decrease of Stream Orders from Land Exchange Alternative B

Parcel (Stream)	Stream Distance (miles)		
	1 st Order	2 nd Order	3 rd Order
Lands Conveyed			
Federal Lands (Yelp Creek and Partridge River)	1.3	4.0	0.0
Lands Acquired			
Tract 1 – Hay Lake (Pike River)	0.0	0.0	8.1
Net Increase/(Decrease)	(1.3)	(4.0)	8.1

Note:

Surface water shoreline distance calculated by GIS analysis.

5.3.6.3.3 Watershed Level Riparian and Aquatic Connectivity

Riparian Connectivity

A comparison of the watersheds containing streams present on the federal lands (Partridge River) and Tract 1 (Pike River) using the RCI is presented in Table 5.3.6-12. The index was developed from GIS analysis of vegetative cover along riparian areas where agriculture and land development have affected natural riparian vegetative cover.

Under Land Exchange Alternative B, there would be a slight increase to the federal estate in watershed riparian connectivity. The streams on both the federal lands and Tract 1 are located within watersheds with existing high quality riparian connectivity.

Table 5.3.6-12 Watershed Riparian Connectivity Index Comparison

Surface Water Lands Conveyed	Tract	Watershed	Percent Agriculture in Riparian Zone	Percent Development in Riparian Zone	RCI Score ¹
Partridge River/Yelp Creek	Federal Lands	St. Louis	0	5	95
Lands Acquired					
Pike River	1 - Hay Lake	Vermillion	0	1	99
Net Increase (Decrease)			0	(4)	4.0

Source: Adopted from MDNR 2015a.

Note:

¹ RCI score calculated with MDNR formula using *Percent Agriculture and Percent Development in Riparian Zone*; scale is from 0 to 100 where 100 indicates excellent riparian conductivity.

Aquatic Connectivity

A comparison of the watersheds containing streams present on the federal lands (Partridge River) and Tract 1 (Pike River) using the ACI is presented in Table 5.3.6-13. The index was developed from GIS analysis of structures (i.e., dams, bridges, and culverts) along stream systems in the watershed.

Land Exchange Alternative B would result in the Superior National Forest acquiring streams located in watersheds with significantly better aquatic connectivity values, indicating increased aquatic habitat.

Table 5.3.6-13 Watershed Aquatic Connectivity Index Comparison

Surface Water Lands Conveyed	Tract	Watershed	Aquatic: Bridges and Culverts (miles stream/# structures)	Aquatic: Dams (miles stream/# structures)	ACI Score ¹
Partridge River	Federal Lands	St. Louis	15	6	11
Lands Acquired					
Pike River	1 - Hay Lake	Vermillion	41	11	26
Net Increase (Decrease)			26	5	15

Source: Adopted from MDNR 2015b.

Note:

¹ ACI score calculated by dividing total miles of streams and ditches per watershed by total number of culverts, bridges, and dams; scale is from 0 to 100 where 100 indicates free flowing streams (no structures) and 0 indicates one structure for every 20 miles of flowing water.

5.3.6.3.4 Aquatic Species

As with the Land Exchange Proposed Action, a semi-quantitative comparison of the net increase or decrease to the federal estate of aquatic species was made for species located within the vicinity of the Tract 1 parcel boundaries since representative survey sites located in the vicinity of the parcel are likely similar to the existing aquatic habitats present at the parcel (see Section 4.2.6).

Fish Assemblages

Two survey sites were analyzed within the vicinity of both the smaller federal parcel and within the vicinity of Tract 1. The smaller federal parcel and Tract 1 had six species in common. Land Exchange Alternative B would potentially result in a net decrease to the federal estate of four species, including two pollution-intolerant species (see Table 5.3.6-14). Given the fact that only representative survey sites were used for Tract 1, it is possible that some species are more or less prevalent than is noted here. The attributes of the fish assemblages located at each survey site indicate that Land Exchange Alternative B would result in minimal change to the fish habitat for the portions of the river the Superior National Forest would acquire. The dominant fish species present at each site indicate that the stream characteristics were consistent with slower-moving, glide pool features.

Table 5.3.6-14 Increase or Decrease of Stream Fish Assemblage for Land Exchange Alternative B

Combined Studies Within, or Within Vicinity of, Surface Water	Tract	Total Species (#)	Pollution- Intolerant Species (#)	Pollution- Tolerant Species (#)
Lands Conveyed				
Partridge River/Yelp Creek	Federal Lands	15	4	4
Lands Acquired				
Pike River	Tract 1	11	2	4
Net Increase (Decrease)		(4)	(2)	0

Source: Adopted from Section 4.2.6.

Benthic Macroinvertebrate Assemblages

Macroinvertebrate baseline surveys completed within, and in the vicinity of, the smaller federal parcel ranked macroinvertebrate assemblages as fair within the second-order stretches of the Partridge River, as indicated by the HBI pollution index (see Table 5.3.6-15). The first- and fourth-order segments of the streams within the vicinity of Tract 1 indicated macroinvertebrate assemblages ranging from good to fair. A qualitative comparison using the attributes of HBI, stream order, total families (diversity), and percent pollution-tolerant organisms indicate that the macroinvertebrate assemblages would likely be similar under Land Exchange Alternative B. This qualitative comparison assumes the habitat and associated macroinvertebrate assemblages are similar in the stream segments within the third-order segment of the Pike River on Tract 1.

Table 5.3.6-15 Stream Macroinvertebrate Assemblage Comparisons for Land Exchange Alternative B

Attributes	Federal Lands		Non-federal Lands (study areas within vicinity of Tract 1)	
	PR-west	PR-east	MPCAB-05RN029	MPCAB-05RN077
Study site				
Stream order	2	2	1	4
HBI score	6.4	6.0	5.7	5.1
HBI ranking	Fair	Fair	Fair	Good
Total families	11	10	11	31
Percent pollution-tolerant	8	18	3	5

Source: Adopted from Barr 2011b and MPCA 2011c.

5.3.6.3.5 Aquatic Species of Greatest Conservation Need

The smaller federal parcel includes the Laurentian and Nashwauk Uplands ecological subsections, while Tract 1 includes only the Nashwauk Uplands.

As discussed in Section 5.3.6.2.5, SGCN species are associated with these ecological subsections based on occurrence and habitat considerations. Using the approach of comparing SGCN species by subsection association only, Land Exchange Alternative B would likely result in no net change to the federal estate of SGCN species (see Table 5.3.6-16).

Regardless of the potential indicated by subsection association, no SGCN species were identified within the boundaries of the smaller federal parcel. Habitat is present in at least some locations within these boundaries for SGCN species. Although no surveys were completed within the boundaries of Tract 1, occurrences of the creek heelsplitter, an SGCN species, have been documented within the vicinity of Tract 1 on segments of the Pike River (downstream of Tract 1). The predominant sand substrate documented in survey areas within the vicinity of this SGCN occurrence location and the possibility that similar substrates exist within the boundaries of Tract 1 indicate the creek heelsplitter may exist within the Pike River segments of Tract 1. A qualitative review of these data indicates that Land Exchange Alternative B may result in the added presence to the federal estate of the creek heelsplitter.

Table 5.3.6-16 Ecoregion SGCN Species Comparisons for Land Exchange Alternative B

SGCN Species	Common Name	Federal Lands (Laurentian and Nashwauk Uplands)	Tract 1 (Nashwauk Uplands only)
Fish			
<i>Ichthyomyzon fossor</i>	Brook lamprey	X	X
Mussels			
<i>Lasmigona compressa</i>	Creek heelsplitter	X	X
<i>Ligumia recta</i>	Black sandshell	X	X
Total species		3	3

Source: Adopted from Section 4.3.6.

5.3.6.4 Land Exchange No Action Alternative

Under the Land Exchange No Action Alternative, the Superior National Forest would have an ongoing responsibility for managing aquatic resources on the federal lands in accordance with the Forest Plan. The Land Exchange No Action Alternative would not change the USFS responsibility for managing aquatic resources and would result in no further effects on existing aquatic species or habitats.

Fish and other aquatic life on the federal lands would be exposed to the water quality, hydrologic, and physical habitat conditions that currently exist as a result of past mining activities. There would be no change from existing conditions, although it is expected that the water quality of the Embarrass River may improve as a result of corrective actions potentially required by the reissuance of existing NPDES/SDS permits in the NorthMet Project area. Future actions conducted under the Cliffs Erie Consent Decree may also change these conditions.

The non-federal lands would not go into USFS ownership, and land use would be determined by the private land owners. Effects to aquatic resources are difficult to predict given the uncertainty

of future potential land use. Some lands may be developed, resulting in potential effects to aquatic species at the individual and local population levels, decreases in habitat, and adverse effects on habitat connectivity.

-Page Intentionally Left Blank-

5.3.7 Air Quality

Because there are no current operations or activities on the non-federal parcels that would result in a change to ambient air quality, the Land Exchange Proposed Action (and alternatives) would not result in new effects on the federal estate. Indirect effects from the NorthMet Project Proposed Action on the non-federal parcels are considered under Class I area modeling and are discussed in Section 5.2.7.

-Page Intentionally Left Blank-

5.3.8 Noise and Vibration

Evaluation of potential noise, vibration, and airblast effects in the areas of the Land Exchange Proposed Action used the same methodologies and criteria that were described previously for the NorthMet Project Proposed Action. The results of the modeling indicate that noise, vibration, and airblast levels that would be experienced at or by sensitive receptors would be below the Minnesota standards. Therefore, operations at the Mine Site and Plant Site would not have a significant effect on human receptors within the federal and non-federal lands, including people that may use the non-federal lands for recreational activities such as hunting and hiking (if the Land Exchange Proposed Action were to occur and the non-federal lands were added to the Superior National Forest). As discussed in Section 5.2.8, tribal users of archaeological sites (Spring Mine Lake Sugarbush, *Mesabe Widjiu*, and BBLV Trail; see Section 4.2.9) in the immediate vicinity of the Mine Site and Plant Site could experience some effects from noise. The non-federal land tracts are approximately 10 to 90 miles from operations at the Mine Site and Plant Site; tracts located 50 to 90 miles away from the federal lands are outside the area of analysis for noise modeling and would be not affected by noise from operations at the Mine Site and Plant Site.

5.3.8.1 Methodology and Evaluation Criteria

The noise and vibration impact assessment area for the Land Exchange Proposed Action would involve transferring 6,495.4 acres of federal lands from public to private ownership, and up to 7,075.0 acres of land from private to public ownership. The spatial and temporal area of analysis assessed for noise, vibration, and airblast as part of the Land Exchange Proposed Action included the indirect effects resulting from the mining activities; therefore, the area of analysis is the same as that described in Section 5.2.8.1. As indicated before, three desktop computer models (ISO 9613-2 sound-propagation model, the Site Law formula, and the Terrock model) were used to evaluate noise, ground vibration, and airblast effects, respectively, on the federal and non-federal lands.

5.3.8.2 Land Exchange Proposed Action

5.3.8.2.1 Federal Lands

The topography and land cover of the federal lands are similar to those of the Mine Site previously discussed, but include additional area to the west and northwest that are mostly wetland. NorthMet Project Proposed Action-related activities that would result in noise, vibration, or airblast would not occur on the additional federal lands (3,776.1 acres) situated west and northwest of the Mine Site, so no additional noise, vibration, or airblast effects would occur in this area. It should be noted that the federal land excludes private lands (295.2 acres) situated south of Dunka Road. There are no residential areas or individual houses within the federal lands that could be affected by the NorthMet Project Proposed Action's noise and vibration-related activities (see Figures 5.3.8-1 to 5.3.8-4). As discussed in Section 5.2.8.2, noise and vibration levels from the Mine Site would be too low to significantly affect the recreational use of the federal land (i.e., minor effects in 11,456 acres around the Mine Site).

-Page Intentionally Left Blank-

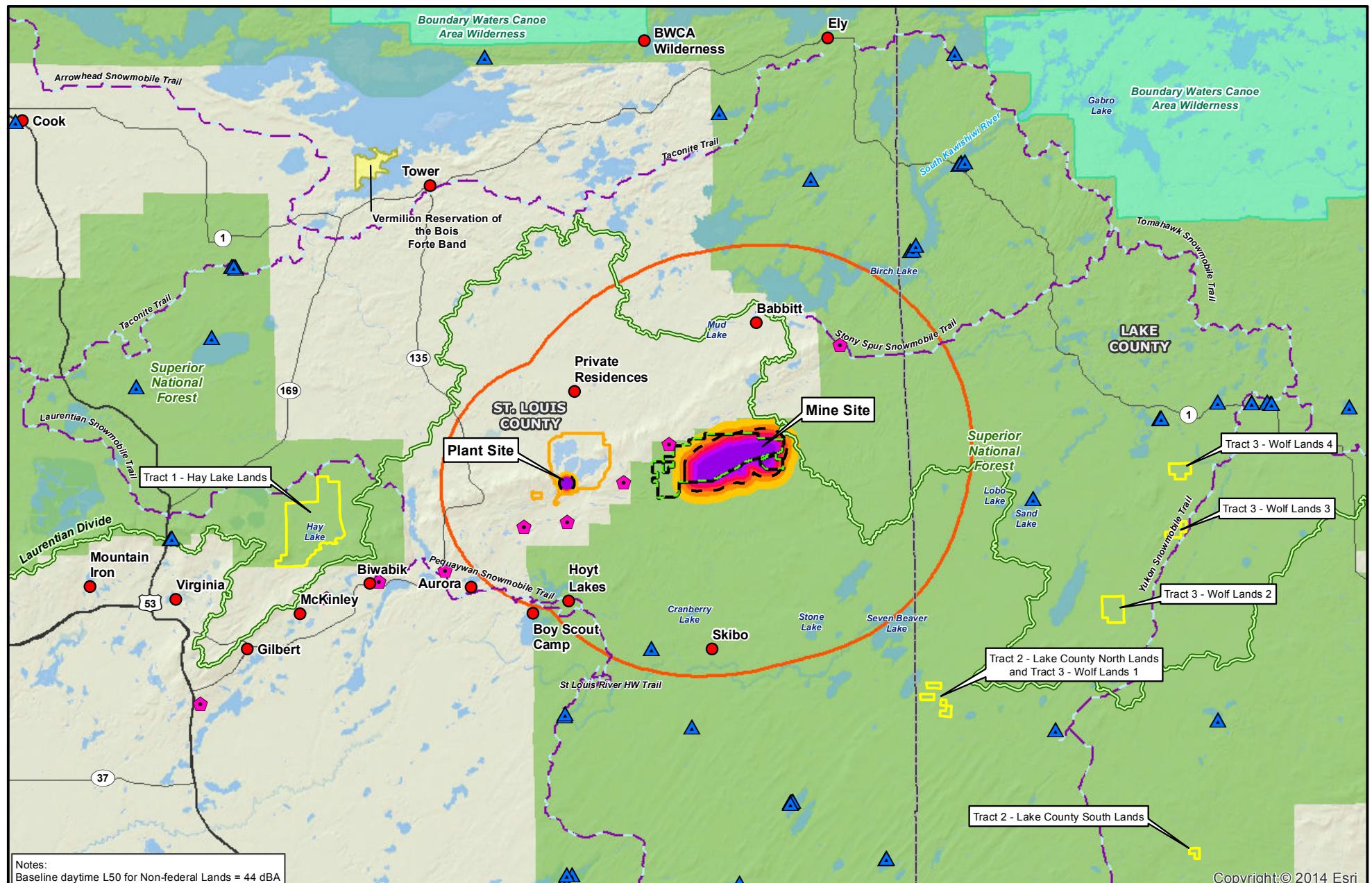


Figure 5.3.8-1
Predicted Daytime L50 Noise Contours at Non-federal Tracts (Includes Baseline L50 Levels)
 NorthMet Mining Project and Land Exchange FEIS
 Minnesota

November 2015

Notes:
 Baseline daytime L50 for Non-federal Lands = 44 dBA

● Noise Sensitive Receptor	▲ Recreational Site	L MN L50 Daytime Noise Standard: 60 dBA
■ Non-federal Lands	■ Native American Reservation	60-64.9
■ Federal Lands	■ Boundary Waters	65-69.9
■ Plant Site	■ Canoe Area Wilderness	70-74.9
■ Mine Site	■ National Forest	75-79.9
◆ Wildlife Travel Corridor		80+

L50 dBA Levels

■ 50-54.9
■ 55-59.9

MNDNR US Army Corps of Engineers St. Paul District FOREST SERVICE U.S. FOREST SERVICE

0 2 4 8 Miles

-Page Intentionally Left Blank-

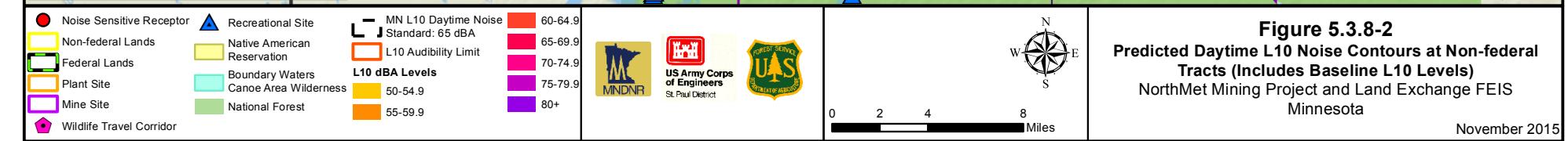
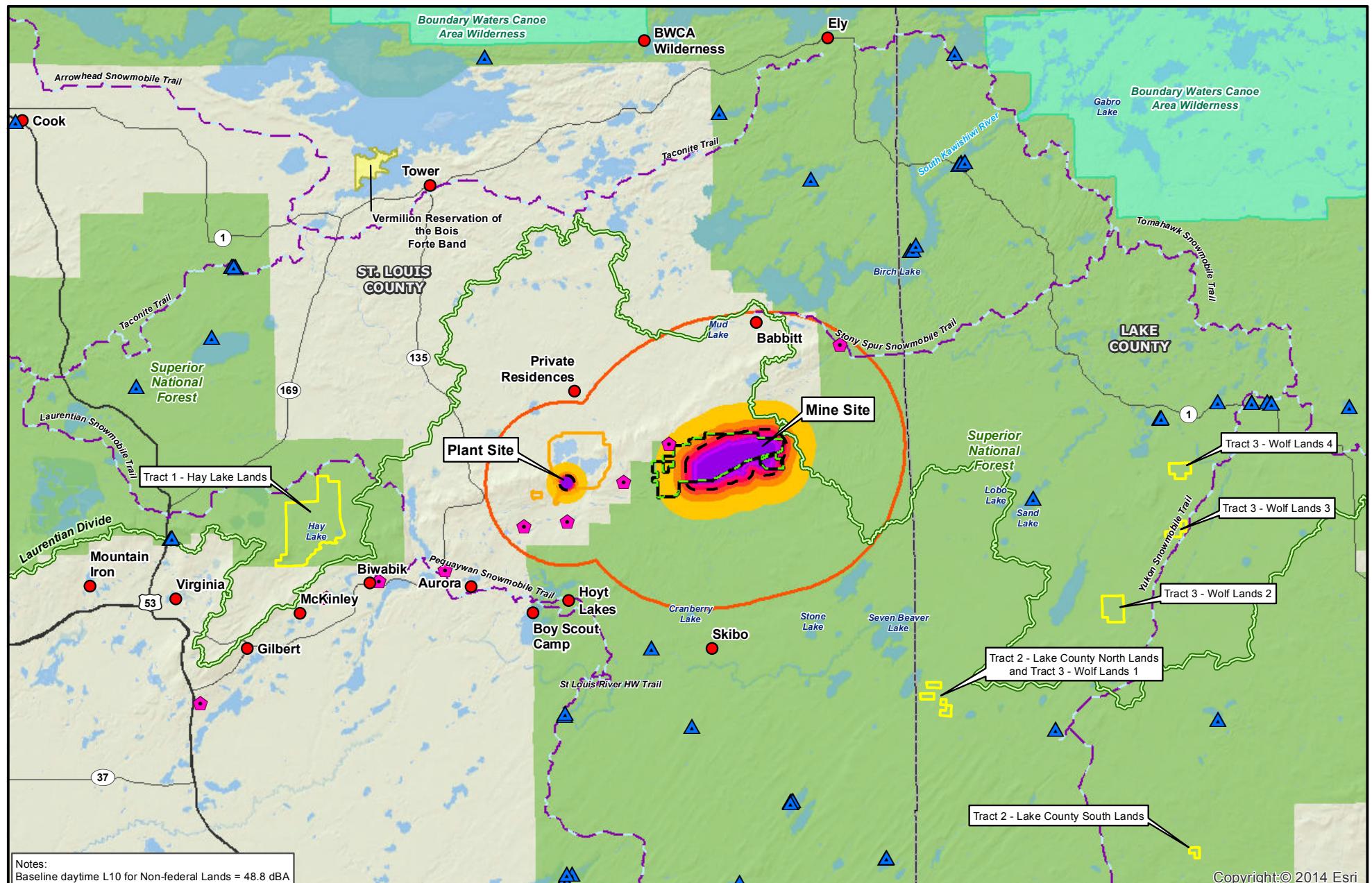
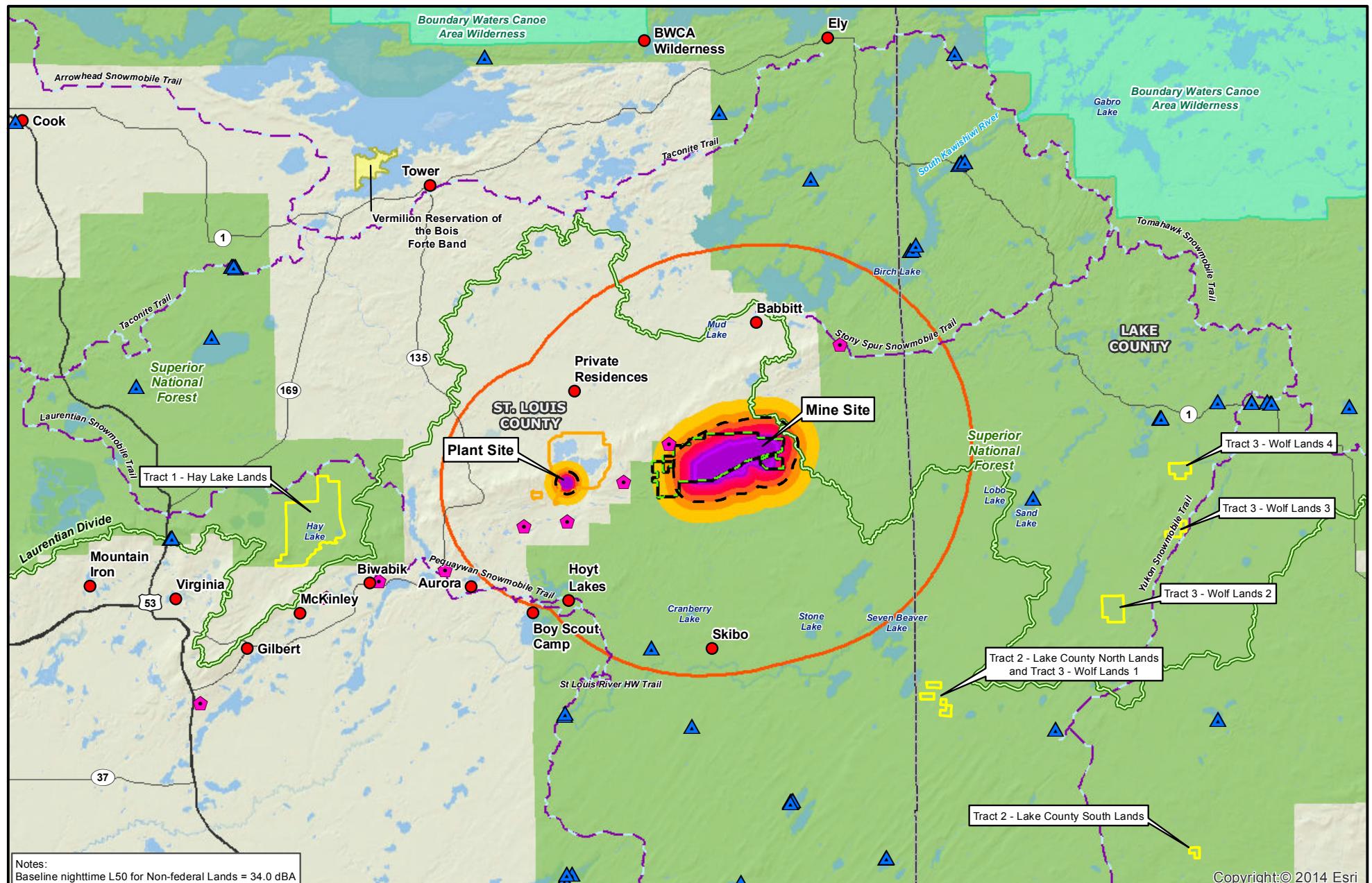


Figure 5.3.8-2
Predicted Daytime L10 Noise Contours at Non-federal Tracts (Includes Baseline L10 Levels)
NorthMet Mining Project and Land Exchange FEIS
Minnesota

November 2015

-Page Intentionally Left Blank-



Notes:
Baseline nighttime L50 for Non-federal Lands = 34.0 dBA

Copyright © 2014 Esri

● Noise Sensitive Receptor	▲ Recreational Site
■ Non-federal Lands	■ Native American Reservation
■ Federal Lands	■ Boundary Waters Canoe Area Wilderness
■ Plant Site	■ National Forest
■ Mine Site	
◆ Wildlife Travel Corridor	

L — MN L50 Nighttime Noise Standard: 50 dBA	50-54.9
— L50 Audibility Limit	55-59.9
L50 dBA Levels	60-64.9
	65-69.9
	70+



Figure 5.3.8-3
Predicted Nighttime L50 Noise Contours at Non-federal Tracts (Includes Baseline L50 Levels)
NorthMet Mining Project and Land Exchange FEIS
Minnesota

November 2015

-Page Intentionally Left Blank-

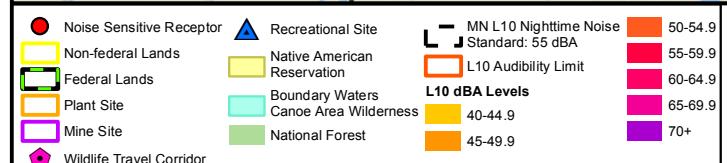
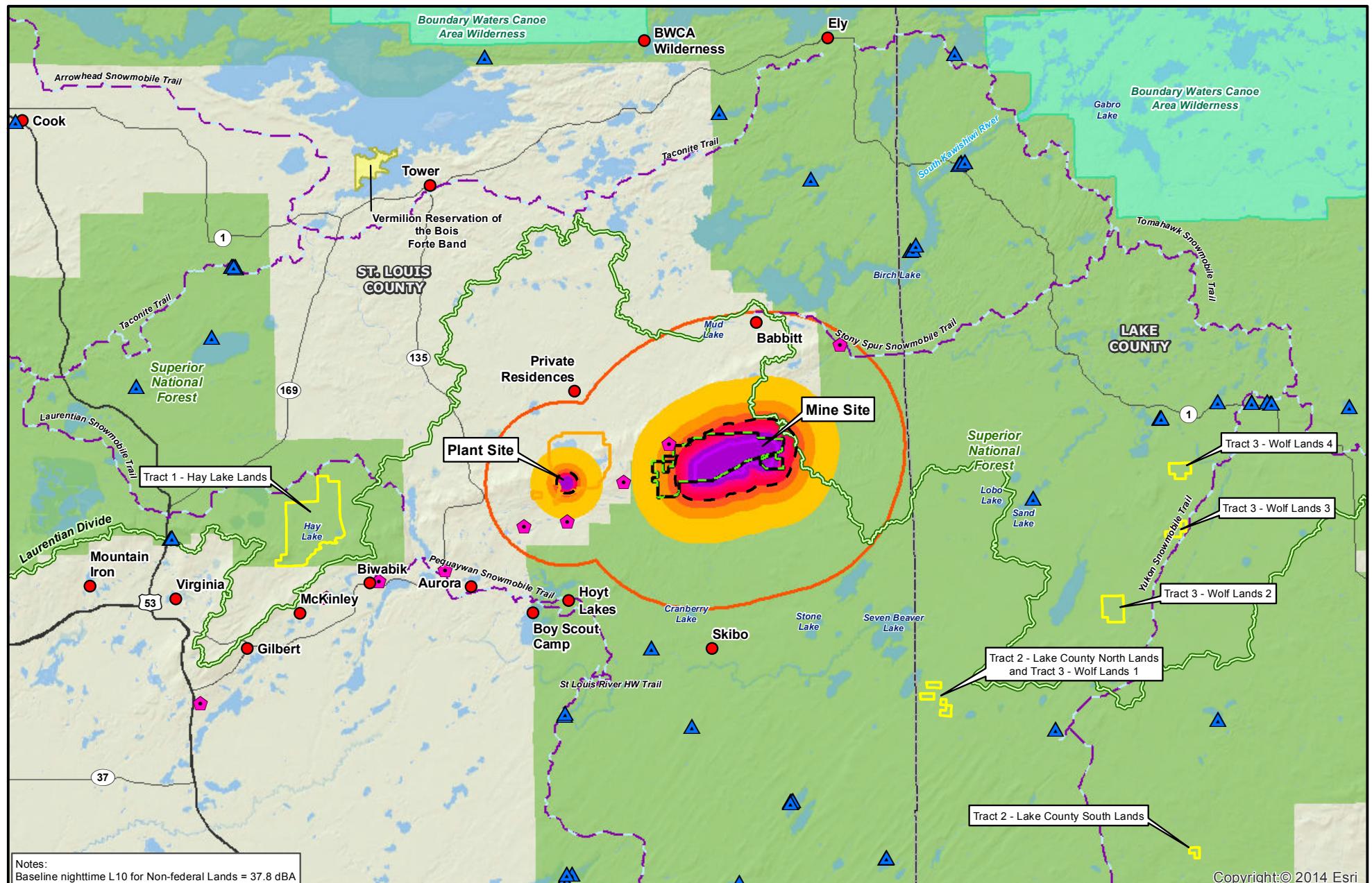


Figure 5.3.8-4
Predicted Nighttime L10 Noise Contours at Non-federal Tracts (Includes Baseline L10 Levels)
NorthMet Mining Project and Land Exchange FEIS
Minnesota

November 2015

-Page Intentionally Left Blank-

5.3.8.2.2 Non-federal Lands

The non-federal lands would be managed consistent with the adjacent forest lands management (see Section 4.3.1). No direct effects from the Land Exchange Proposed Action are anticipated since the USFS currently has no plans for operations on the non-federal lands and no NorthMet Project Proposed Action-related activity (e.g., drilling, blasting, excavation work, material haulage via trucks, and ore crushing) would occur within the non-federal lands.

Review of the most-up-to-date aerial maps indicates that there are no human or residential receptors within or adjacent to the non-federal lands (Tracts 1 to 5). If the Land Exchange Proposed Action were to occur and the non-federal lands were added to the Superior National Forest (i.e., if the tracts became federal lands), public recreational use such as hiking and hunting would likely occur on these tracts.

To determine the indirect effect of operations at the Mine Site and Plant Site on people that may use the non-federal lands for recreational activities such as hiking and hunting, the modeled area was expanded to a 20-mile radius from both the Mine Site and the Plant Site. Daytime and nighttime noise contours (L_{50} and L_{10}) generated from the modeling are shown in Figures 5.3.8-1 through 5.3.8-4. During the daytime, all potential receptors within the non-federal lands were outside the 50-dBA (L_{50} and L_{10}) noise contours. During the nighttime, all potential receptors within the non-federal lands were outside the 40-dBA (L_{50} and L_{10}) noise contours. This shows that the predicted daytime and nighttime noise levels at the non-federal lands due to operations at the Mine Site and Plant Site are well below Minnesota's noise standards. The results of the noise assessment indicate that operations at the Mine Site and Plant Site would add no perceptible noise (0 dBA) to the current baseline levels experienced at the non-federal lands. Non-federal Tracts 4 and 5 are approximately 50 and 90 miles away, respectively, from the federal lands and are outside the area of analysis for noise modeling; neither tract would be affected by noise from operations at the Mine Site and Plant Site.

Based on the information above, it is anticipated that noise from typical mining and hauling operations at the Mine Site and ore-crushing operations at the Plant Site would not affect the people that may use the non-federal lands for recreational activities such as hiking and hunting under the Land Exchange Proposed Action. However, as discussed in Section 5.2.8, tribal users of archaeological sites (Spring Mine Lake Sugarbush, *Mesabe Widjiu*, and BBLV Trail; see Section 4.2.9) in the immediate vicinity of the Mine Site and Plant Site could experience some effects from noise. The non-federal lands are far from the Mine Site and Plant Site (10 to 90 miles away), so indirect vibration levels from operations at both locations would not affect potential receptors within the non-federal lands that would be acquired under the Land Exchange Proposed Action.

5.3.8.3 Land Exchange Alternative B

Under the Land Exchange Alternative B, 4,752.6 acres would be conveyed to PolyMet. The type, quantity, and location of noise- and vibration-related sources (i.e., drilling, blasting, excavation work, haul trucks, trains, and crushers) for the Land Exchange Alternative B would be the same as that for the Land Exchange Proposed Action. Therefore, the Land Exchange Alternative B would not change noise and vibration levels experienced at the federal lands or modify noise and vibration effects on nearest receptors. If the 4,752.6 acres of land were to become privately owned, public recreational use currently associated with the smaller federal parcel would no

longer occur on that portion of the federal lands (i.e., the Land Exchange Alternative B would have no effects associated with public recreational use on that portion). Sections 5.2.8.2.1 and 5.2.8.2.2 provide a discussion of the noise and vibration effects on the federal lands.

Under the Land Exchange Alternative B, Tract 1 (4,926.3 acres) would be acquired by the USFS. The type, quantity, and location of noise- and vibration-related sources (i.e., drilling, blasting, excavation work, haul trucks, trains, and crushers) for this alternative would be the same as that for the Land Exchange Proposed Action. Therefore, the Land Exchange Alternative B would not change noise and vibration levels experienced at the non-federal lands or modify noise and vibration effects on the nearest receptors.

As indicated above, during the daytime, all modeled potential receptors within Tract 1 were outside the 50-dBA (L_{50} and L_{10}) noise contours (see Figure 5.3.8-1 and 5.3.8-2). Similarly, during the nighttime, all potential receptors within Tract 1 were outside the 40-dBA (L_{50} and L_{10}) noise contours (see Figure 5.3.8-3 and 5.3.8-4). The predicted daytime and nighttime noise levels at Tract 1 due to operations at the Mine Site and Plant Site are well below Minnesota's noise standards. The results of the noise assessment indicate that operations at the Mine Site and Plant Site would add no additional noise (0 dBA) to the current baseline levels experienced at Tract 1.

5.3.8.4 Land Exchange No Action Alternative

Under the Land Exchange No Action Alternative, the transfer of lands would not occur and there would be no increase in noise and vibration levels at the federal and non-federal lands. Therefore, there would be no change in noise and vibration levels at the nearest receptors.

5.3.9 *Cultural Resources*

This section summarizes the environmental consequences of the Land Exchange Proposed Action on historic properties that are present on the federal and non-federal lands, including the potential effects, types of avoidance, effect minimization measures, and potential mitigation measures that are relevant to these historic properties. Additionally, this section summarizes the environmental consequences of the Land Exchange Proposed Action and alternatives on 1854 Treaty resources—i.e., those areas and species that are traditionally or culturally important to the Bands. Under the Land Exchange Proposed Action and alternatives, the Superior National Forest would retain its ongoing responsibility for managing cultural resources on Superior National Forest lands in accordance with the Forest Plan.

The federal Co-lead Agencies, after consulting with the SHPO, Bands, and PolyMet, have determined that the Partridge River Segment of the BBLV Trail is eligible for inclusion in the NRHP. The SHPO concurred in this determination. All other cultural resources identified as part of the Land Exchange Proposed Action, as identified in Section 4.3.9.1.1, were determined to be not eligible for inclusion in the NRHP, and therefore did not receive further consideration under Section 106 during review of the Land Exchange Proposed Action.

After consultation with the SHPO, Bands, and PolyMet, the federal Co-lead Agencies have determined that the BBLV Trail Segment would be adversely affected by the Land Exchange Proposed Action. The SHPO agreed with this finding. This determination was used to facilitate consultation with the SHPO, Bands, and PolyMet pertaining to the resolution of adverse effects. The ACHP was notified of adverse effect by letter on May 21, 2015, but declined to participate. The federal Co-lead Agencies are currently in the process of developing a Memorandum of Agreement (MOA), which identifies the steps the federal Co-lead Agencies would take to avoid, minimize, or mitigate the adverse effect.

5.3.9.1 Methodology and Evaluation Criteria

Potential effects associated with the Land Exchange Proposed Action would be the destruction of historic properties and the loss of the historic information and cultural significance that these properties could represent. An additional potential effect would be the loss of federal protection for any unknown historic properties, such as those provided under the NHPA, the Archaeological Resource Protection Act, and the Native American Graves and Repatriation Act. The methodology and evaluation criteria used to determine potential effects on cultural resources from the Land Exchange Proposed Action are similar to those used for the NorthMet Project Proposed Action (see Section 5.2.9).

The analysis of cultural resources for the non-federal lands was performed based on readily available information, and no additional field work was performed. Intensive analysis is only needed for the federal parcel leaving federal ownership. The non-federal lands that would be going into federal ownership would not be of primary concern since future management of these lands would be per Forest Plan direction for heritage resources.

The spatial area of analysis for Land Exchange Proposed Action effects on cultural resources included the boundaries of the federal tracts proposed for the exchange, while the temporal area of analysis was the point in time at which the change in ownership would occur. The geographic extent is appropriate because it includes all cultural resources that would be affected by a change

in site protection. In a temporal sense, the change in ownership is appropriate because this is when there would be a gain or loss of legal protections.

The analysis of the cultural resources affected by the Land Exchange Proposed Action was guided by effects criteria that were developed by the USFS and the USACE. The analysis included a review of known and recorded heritage resources (i.e., historic structures, artifacts, TCPs) within or immediately adjacent to the federal and non-federal lands and a qualitative assessment to determine if there were portions of the federal and non-federal lands that have not been surveyed previously and would have a high probability to yield heritage resources.

5.3.9.2 Land Exchange Proposed Action

5.3.9.2.1 Federal Lands

As outlined in Section 5.2.9, the federal Co-lead Agencies have determined, and the SHPO concurred, that the BBLV Trail Segment is eligible for inclusion in the NRHP. The federal Co-lead Agencies, after consultation with the SHPO, Bands, and PolyMet, have determined that the eligible property will be adversely affected and the SHPO agreed with that finding. Cultural resources located on private lands being transferred to federal ownership would not be considered as adversely affected, but would be considered to have greater preservation protection under federal law in the event the Land Exchange Proposed Action were to occur. The federal Co-lead Agencies are currently in the process of developing an MOA, which identifies the steps the federal Co-lead Agencies would take to avoid, minimize, or mitigate the adverse effect.

The 1854 Treaty resources located within the Land Exchange Proposed Action would be similar to the Mine Site portion of the NorthMet Project area previously discussed in Section 4.2.9. Section 4.2.9 provides further discussion of the existing conditions on the Mine Site and associated federal lands. The Land Exchange Proposed Action represents an exchange of private and federal land, but it is also represents an exchange of access to natural resources expressed in treaties made between the United States and Bands of Ojibwe Indians in the 19th Century. Due to the nature of a land exchange, therefore, the effects would be limited to access to such resources versus direct or indirect effects, as would be the case with the Land Exchange Proposed Action.

An analysis of effects on 1854 Treaty resources, as described and discussed in Section 4.2.9, is limited by the lack of specific information concerning the use of such resources in the Land Exchange area. The cultural resources investigations conducted as part of the Land Exchange Proposed Action included Band member interviews with Bois Forte, Fond du Lac, and Grand Portage, although only Bois Forte's results were made available. The results of the interviews and the cultural resources investigation did not find any natural resources that would be considered a TCP or other traditional cultural place.

There is also no quantitative analysis of current use of 1854 Treaty resources in or near the federal lands. This lack of data also precludes the analysis of how Band members would be quantitatively affected socioeconomically by effects on 1854 Treaty resources, further discussed in Section 5.2.10. The primary source of data for assessing effects on 1854 Treaty resources is from the analysis of the environment in other chapters of this FEIS as discussed in Section 4.2.9.4 and 5.2.9.2.2.

As discussed above, the Land Exchange Proposed Action could have effects on 1854 Treaty resources—i.e., lack of access to those areas and species that are traditionally or culturally

important to the Bands. For example, coniferous bogs contain several plant species that are tribally harvested resources (e.g., cranberries, Labrador tea, creeping snowberry, etc.). Because the non-federal lands contain fewer acres of coniferous bogs than the federal lands, the Land Exchange Proposed Action would result in a net decrease of coniferous bog wetlands on the federal estate.

Band members' use of the federal lands is not well-defined through research at this time and did not emerge through interviews. A good faith effort was made on the part of the federal Co-lead Agencies to identify use areas in or adjacent to the federal lands; however, those efforts resulted in little specific information concerning historic subsistence use and no information regarding recent subsistence activity within the federal lands. As such, cultural effects on the Bands would be difficult to quantify in regards to such incremental increases below standards or effects on species where appropriate mitigation is used.

5.3.9.2.2 Non-federal Lands

There are no known cultural resources on the non-federal lands, except known 1854 Treaty resources consisting of wild rice beds within the Hay Lake lands. Cultural resources located on private lands being transferred to federal ownership would not be considered adversely affected, but would be considered to have greater preservation protection under federal law in the event the Land Exchange Proposed Action were to occur. No wild rice beds would be affected as a result of the Land Exchange Proposed Action as no activities are proposed on the non-federal lands and the proposed mining activities would not affect these lands.

The Land Exchange Proposed Action represents an exchange of non-federal and federal land, but it also represents an exchange of access to natural resources expressed in treaties made between the United States and Bands of Ojibwe Indians in the 19th Century. Due to the nature of a land exchange, therefore, the 1854 Treaty resources would be available for resource gathering and subsistence use by the Bands and would receive greater protection under federal law than they are currently receiving.

5.3.9.3 Land Exchange Alternative B

5.3.9.3.1 Federal Lands

All of the cultural resources and 1854 Treaty resources identified and discussed in Section 5.3.9 are located within the Land Exchange Alternative B. Effects on these resources would be the same as discussed in Section 5.3.9.

5.3.9.3.2 Non-federal Lands

There are no known cultural resources on the non-federal lands, except known 1854 Treaty resources consisting of wild rice beds within the Hay Lake lands. The non-federal lands that would be going into federal ownership would not be of primary concern for cultural resources since future management of these lands would be as per the Forest Plan direction for cultural resources. Cultural resources located on private lands being transferred to federal ownership would not be considered adversely affected, but would be considered to have greater preservation protection under federal law in the event the Land Exchange Proposed Action were to occur. No wild rice beds would be affected as a result of the Land Exchange Alternative B as no activities are proposed on the non-federal lands and the proposed mining activities would not

affect these lands. The Land Exchange Alternative B represents an exchange of private and federal land, but it also represents an exchange of access to natural resources expressed in treaties made between the United States and Bands of Ojibwe Indians in the 19th Century. Due to the nature of a land exchange, therefore, the 1854 Treaty resources would be available for resource gathering and subsistence use by the Bands and would receive greater protection under federal law than they are currently receiving.

5.3.9.4 Land Exchange No Action Alternative

There would be no effects on cultural resources or 1854 Treaty resources under the Land Exchange No Action Alternative.

5.3.10 Socioeconomics

This section describes the potential socioeconomic consequences of the Land Exchange Proposed Action. Overall, the Land Exchange Proposed Action would have the following socioeconomic effects:

- Positive economic effects due to the value of forestry products made available on the non-federal lands, as well as jobs and revenue due to increased visitation of the non-federal lands;
- Undetermined effects for EJ populations and subsistence activities, due to the net increase in the amount of land available for subsistence activities, but unknown changes in the type and extent of subsistence resources on the federal and non-federal lands; and
- Negligible effects on other socioeconomic considerations.

5.3.10.1 Methodology and Evaluation Criteria

As discussed in Section 5.2.10, the study area for socioeconomics differs from the study area used for much of the rest of this FEIS. It includes Cook, Lake, and St. Louis counties. This includes, where appropriate, the St. Louis County municipalities listed in Section 4.2.10. The primary issues related to socioeconomics on and near the non-federal lands, and therefore the potential for effects, would include the following:

- The amount of annual property taxes lost to the county from non-federal lands going to federal ownership;
- The potential change in payment in lieu of taxes to the county from the Land Exchange Proposed Action;
- The differences in assessed market values of federal lands compared to non-federal lands proposed for exchange;
- The difference between present values of recently harvested (past 10 years) products from the federal parcels and the value of products from the federal parcels;
- The difference between present and future values of potential forest products in Land Exchange Proposed Action parcels;
- The change in forestry employment on federal and non-federal parcels (estimated);
- A qualitative assessment of public visitation to the federal tract and estimated/potential visitation to non-federal tracts;
- The difference between present and future estimated spending on recreational tourism;
- The difference between present and future amounts of 1854 Treaty resources in Land Exchange Proposed Action parcels; and
- A qualitative assessment of tribal use of the federal parcels and estimated/potential use of the non-federal parcels.

5.3.10.2 Land Exchange Proposed Action

This section describes the potential socioeconomic effects of the Land Exchange Proposed Action on communities in the socioeconomics study area. The Land Exchange Proposed Action would create moderate positive economic effects through increased opportunity for forestry and recreation and associated employment, earnings, and revenue. The Land Exchange Proposed Action would have negligible negative effects on other socioeconomic factors, including housing, public facilities and services, EJ populations, and subsistence.

5.3.10.2.1 Economic Activity

There is no current economic activity (e.g., forestry, etc.) on the federal lands, although harvesting of forest products is permitted by the Forest Plan. More importantly, the federal lands are not accessible to the public for economically measurable use, such as forestry or recreation (see Section 5.2.11). Thus, while the federal lands may hold some theoretical economic value for timber harvest, their practical economic value is zero. Table 5.3.10-1 lists data and observations relevant to the economic value of the federal and non-federal lands.

Tax Payments

Implementation of the Land Exchange Proposed Action would transfer ownership of the federal lands to PolyMet, and would result in an active mining operation that would generate federal, state, and local tax revenue, in addition to employment. As described in Section 5.2.10.2.3, total annual direct tax payments from the NorthMet Project Proposed Action during operations are expected to be in the range of \$37 to \$80 million, a positive economic effect, both on an absolute basis and when compared with the minimal current economic activity within the NorthMet Project area.

The amount of property taxes that would be paid to St. Louis County for the federal lands has not yet been determined; however, property taxes would be included in the overall taxes paid by PolyMet, shown in Table 5.2.10-3. For the non-federal lands, increases to federal payments in lieu of taxes to study area counties as a result of the Land Exchange Proposed Action would be negligible (compared to the current payment in lieu for the federal lands).

Table 5.3.10-1 Economic Value of Federal and Non-federal Lands (in 2012 dollars)

Land	Acreage	Annual Property Tax ¹	Annual Payment in Lieu of Taxes (PILT) ²	Market Value of Land ³	Other Economic Value
<i>Federal Lands</i>	6495.4	NA ⁴	\$2,273.39	TBD	NA
Tract 1	4,926.3	\$20,714.68	\$1,724.10	TBD	Potential recreational value due to the presence of Hay Lake (boating, fishing), existing trails, evidence of ongoing hunting, and other recreational activity (see Section 4.3.11).
Tract 2	381.9	\$2,563.54	\$133.70	TBD	NA
Tract 3	1,575.8	Unknown	\$551.60	TBD	NA
Tract 4	160.2	\$739.30	\$56.00	TBD	NA
Tract 5	30.8	\$1,938.00	\$10.85	TBD	Potential recreational value. Former site of a cabin and camp site owned by Carleton College. Adjacent to highly scenic McFarland Lake (boating, fishing, access to BWCAW) (see Section 4.3.11).
<i>Subtotal, Non-Federal Lands</i>	7,075.0	\$25,995.52	\$2,476.25	TBD	NA
Net Change⁵	579.6	NA	\$202.86	TBD	NA

Notes:

¹ Source: PolyMet, Pers. Comm., April 17, 2012.

² Source: DOI 2012

³ See Market Value section below.

⁴ Table 5.2.10-3 describes total estimated taxes that PolyMet expects to pay for the federal lands. The amount specifically anticipated for property taxes has not been determined.

⁵ Calculated as (non-federal) minus (federal).

TBD = To be determined

Market Value

Federal regulations governing land exchanges, contained in 36 CFR 254.12, require that the assessed value of non-federal land being exchanged be equal to or within 25 percent of the assessed value of the federal land being exchanged. Assessment data have been updated and are included in this FEIS.

Recreation Value

Tracts 1 and 5 also have the potential for recreational use (whereas the federal lands are not easily accessible for any purpose). To the degree that the USFS manages these lands (and the other non-federal lands) for active recreational activity, the Land Exchange Proposed Action could increase economic activity associated with recreation and tourism. The non-federal lands comprise less than half of 1 percent of the 2,171,603.9 acres of Superior National Forest that are managed by USFS, so any such increase would be small.

Timber

There is no ongoing forestry activity on the federal lands, and no evidence of recent past forestry activity. Portions of Tracts 2, 3, and 4 show some evidence of timber harvesting, and a timber harvest agreement is in place through 2013 for the Wolf Lands 3 parcel (see Section 4.3.1). Likely USFS management area designations for the non-federal lands would allow timber harvesting on 6,547.1 acres of the non-federal lands (the lands designated General Forest or General Forest – Longer Rotation; see Table 5.3.1-1). Thus, the Land Exchange Proposed Action could increase timber production in Superior National Forest.

On average, 1 percent of timber land in Superior National Forest is harvested each year, with an estimated value of \$400 (gross) per harvested acre (MDNR, Pers. Comm., April 26, 2012). Timber harvesting on the non-federal lands (and any other USFS lands) would occur only after completion of forest planning, when acres that are eligible for harvest are identified and the offered for sale. For planning purposes, if 1 percent of the non-federal lands would therefore generate gross proceeds of approximately \$26,188 per year. This represents approximately 2 percent of the \$1,435,900 value of timber harvests in Superior National Forest in 2011 (MDNR, Pers. Comm., April 26, 2012), although the markets for timber, and thus the value of harvested timber, can change dramatically. This additional activity would be estimated to generate fewer than 20 new jobs in the region. Minnesota averages approximately one forestry job (including logging and primary manufacturing) per 350 acres of annual harvest, and each direct forestry job generates another 3.6 indirect and induced jobs (MDNR, Pers. Comm., April 26, 2012). Using these estimates, the Land Exchange Proposed Action could generate four direct and 12 indirect jobs. As of 2009, forestry activities employed approximately 1,287 individuals in the study area (Headwaters Economics 2009).

Environmental Justice and Subsistence

Potential EJ populations, as well as the EJ and subsistence effects of the Land Exchange Proposed Action on the federal lands, are described in Section 5.2.10.2.7. Although tribal entities possess usufructuary rights to hunt, fish, and gather throughout the 1854 Ceded Territory, the federal lands are not easily accessible for such subsistence activities. The Land Exchange Proposed Action would involve the transfer of 6,495.4 acres of inaccessible federal lands from

public to private ownership, and up to 7,075.0 acres of publicly accessible land from private to public ownership. To the degree that increased availability of publicly accessible land improves property value and generates revenue (see above) in the study area, the Land Exchange Proposed Action could have positive effects on EJ populations.

As a result of the Land Exchange Proposed Action, the current federal lands would become unavailable for subsistence use. Resource-specific sections of the FEIS address the degree to which subsistence species and resources are likely to be available on the non-federal lands. As described in Section 5.2.9, subsistence has both economic and cultural components; for the Bands, the harvest of a particular animal or plant is intrinsically linked to the place and nature in which it was harvested. Thus, a “net change” in subsistence activity associated with the Land Exchange Proposed Action cannot be calculated in the same way as, for example, the net change in employment or income. The Land Exchange Proposed Action would result in the loss of subsistence resources and opportunities on the federal lands, and a gain in subsistence resources and opportunities on the non-federal lands.

Other Socioeconomic Considerations

The Land Exchange Proposed Action would result in slight increases in demand for public safety services to assist recreational or other users of the non-federal lands. This is a demand that currently does not exist on the inaccessible federal lands. The non-federal lands represent 0.2 percent of the Superior National Forest. Thus, any such increased demand would be marginal. No new housing (and thus no increased demand for educational facilities) is anticipated on the non-federal lands. Any utilities extended to the non-federal lands (such as electricity) would likely be minimal in nature (given the ROS categories assigned to the non-federal lands—see Section 5.3.11). Thus, the Land Exchange Proposed Action would have negligible effects on other socioeconomic considerations.

The Land Exchange Proposed Action would result in a loss of some of the ecosystem functions provided by the forest, wetland, and other natural habitats on the federal lands, particularly the portions of the federal lands (i.e., the Mine Site) where habitat would be replaced by mine facilities. Some of these functions could be restored during the post-closure period, when the federal lands (as well as the Plant Site) are revegetated. In exchange, the Land Exchange Proposed Action would enable the USFS to directly manage the ecosystems functions on the non-federal lands.

5.3.10.3 Land Exchange Alternative B

Under the Land Exchange Alternative B, 4,752.6 acres of federal lands would be exchanged for the 4,926.3-acre Tract 1. The remainder of the federal lands would remain inaccessible by land. The Land Exchange Alternative B would create moderate positive economic effects through increased opportunity for forestry and recreation and associated employment, earnings, and revenue (see Table 5.3.10-1); however, these benefits would be less than from the Land Exchange Proposed Action. Similarly, the Land Exchange Alternative B would have negligible negative effects on other socioeconomic factors, including housing, public facilities and services, EJ populations, and subsistence, although less so than the Land Exchange Proposed Action.

5.3.10.4 Land Exchange No Action Alternative

Under the Land Exchange No Action Alternative, the NorthMet Project Proposed Action would not be developed, there would be no change to the federal lands, and the non-federal lands would remain inaccessible to the public (including tribal entities). Given other private ownership (e.g., the Dunka Road and railroad), the federal and non-federal lands would remain generally inaccessible to the public. Therefore, there would be no direct or indirect effects on socioeconomics.

5.3.11 Recreation and Visual Resources

This section describes the potential environmental consequences of the Land Exchange Proposed Action on recreational facilities and activities that typically take place on the federal and non-federal lands. In this section, effects on the federal and non-federal lands are discussed together, to facilitate calculation of net changes in recreation and scenic classes. Under the Land Exchange Proposed Action and Land Exchange Alternative B, the Superior National Forest would retain its ongoing responsibility for managing recreational resources on National Forest System lands in accordance with the Forest Plan.

Overall, the Land Exchange Proposed Action would increase opportunities for recreational activity through the acquisition of up to 7,075.0 acres of publicly accessible land (the non-federal lands) in exchange for 6,495.4 acres of federal land that are not publicly accessible by land, and thus cannot be practically used for recreation. The Land Exchange Proposed Action would also increase the amount of land controlled by the USFS in the Superior National Forest with Moderate and High SIOs.

The Land Exchange Alternative B would have a lesser degree of the same type of benefits for recreation and visual resources as the Land Exchange Proposed Action, due to the reduced land area involved.

Table 5.3.11-1 shows the effects of the Land Exchange Proposed Action and the Land Exchange Alternative B on acreage of various ROS classes; Table 5.3.11-2 shows the effects on SIO classes.

Table 5.3.11-1 Net Increase or Decrease of Recreation Opportunity Spectrum Classes

Alternative	Increase (Decrease) of ROS Class (Acres)			
	Semi-Primitive Motorized	Semi-Primitive Non-Motorized	Roaded Natural	Total
Land Exchange Proposed Action	(2,243.3)	2,309.9	513.0	579.6
Land Exchange Alternative B	(2,972.7)	2,162.2	984.2	173.7

Table 5.3.11-2 Net Increase or Decrease of Scenic Integrity Objectives

Alternative	Increase (Decrease) of Scenic Integrity Objective (Acres)			
	High	Moderate	Low ¹	Total ¹
Land Exchange Proposed Action	136.3	1,644.6	(1,170.8)	610.1
Land Exchange Alternative B	20.4	1,315.4	(1,153.2)	182.6

Note:

¹ Mud Lake would not be managed by the USFS, and therefore does not have an SIO.

5.3.11.1 Methodology and Evaluation Criteria

5.3.11.1.1 Recreation

The primary issues related to recreational facilities and activities associated with the Land Exchange Proposed Action on and near the federal lands and non-federal lands include the following:

- Change in areas of ROS classes within the Superior National Forest; and
- Qualitative difference in recreation opportunities, as measured using ROS classes, between outgoing federal land and non-federal lands to be acquired.

ROS classes are defined by the USFS (1982) and ROS classes for the non-federal lands were mapped to match the existing mapped ROS Spectrum areas on surrounding adjacent federal lands. GIS analysis was employed to determine the net change in acreage by ROS class. ROS classes are discussed in Section 4.2.11.1.1.

5.3.11.1.2 Visual Resources

The primary issue related to visual resources on and near the non-federal lands is the change in acreage of High, Moderate, and Low SIO classified land within Superior National Forest lands. SIOs were provided by USFS (1995), and as with ROS classes, SIOs for the non-federal lands were mapped to match the existing mapped SIOs on surrounding adjacent federal lands. GIS analysis was employed to determine the net change in acreage by SIO. SIOs are discussed in section 4.2.11.1.2. This quantitative analysis was supplemented by a qualitative description of loss of scenery opportunities on federal lands that would be conveyed to PolyMet and the gain of scenery opportunities on non-federal lands to be acquired and managed by USFS.

5.3.11.2 Land Exchange Proposed Action

5.3.11.2.1 Recreation

ROS classes for the federal lands are shown on Figure 5.3.11-1; the classes that would be applied to the non-federal lands are also shown on Figures 5.3.11-2 and 5.3.11-3. These classifications are summarized in Table 5.3.11-3. No developed recreational sites or opportunities are planned at this time. All of the tracts would be open for non-motorized, dispersed recreational activities. The federal lands in the Land Exchange Proposed Action consist of 967.0 acres designated as Roaded Natural and 5,528.4 acres designated Semi-Primitive Motorized (see Table 5.3.11-3). As described in Sections 4.2.11 and 4.3.11, the Semi-Primitive (Motorized and Non-Motorized) classes indicate areas where interaction between visitors is rare, but where human activities may be visible. The Roaded Natural class indicates an area where evidence of human activity and interactions are more frequent, and occasionally prevalent.

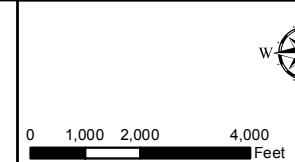
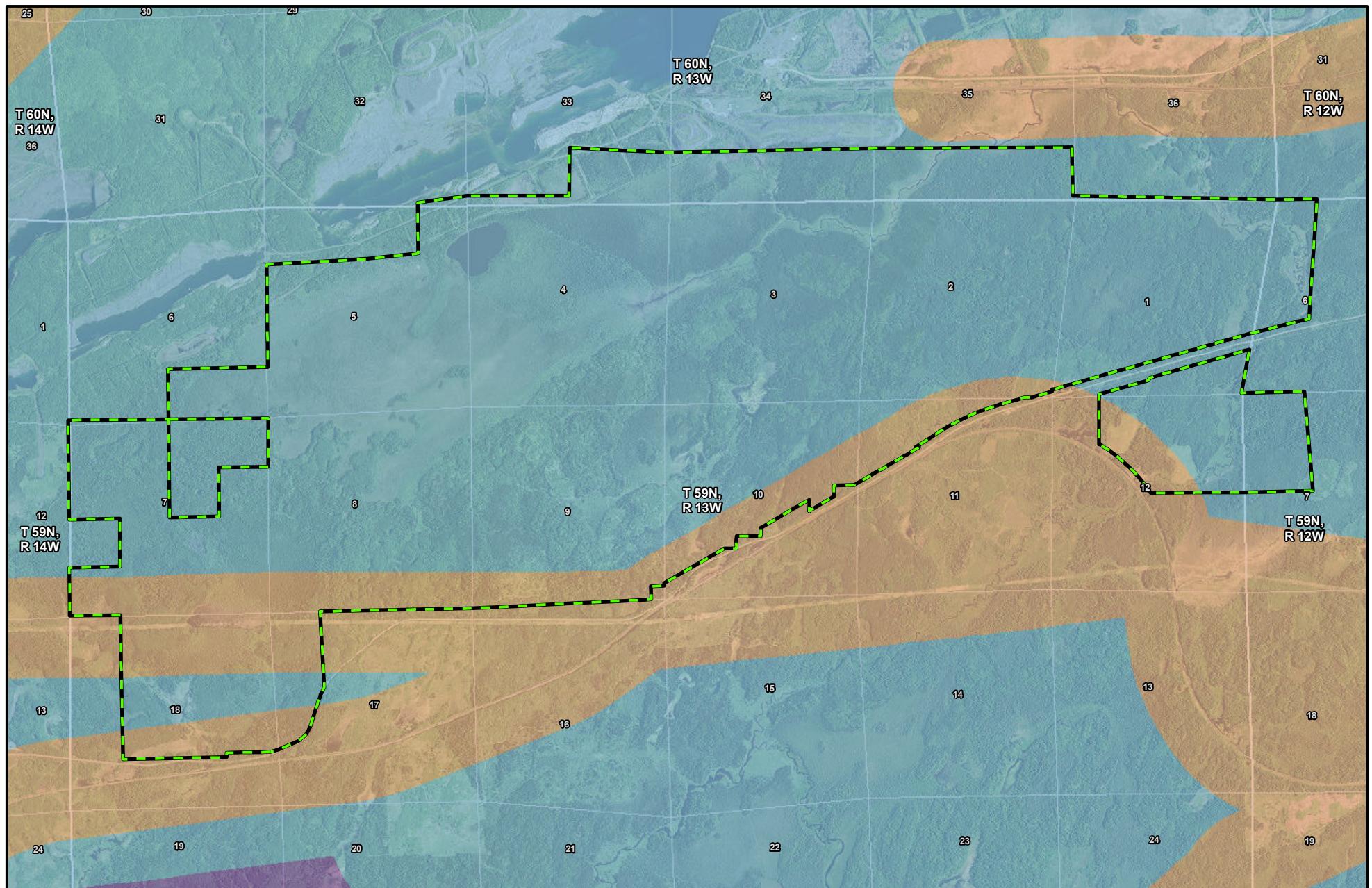
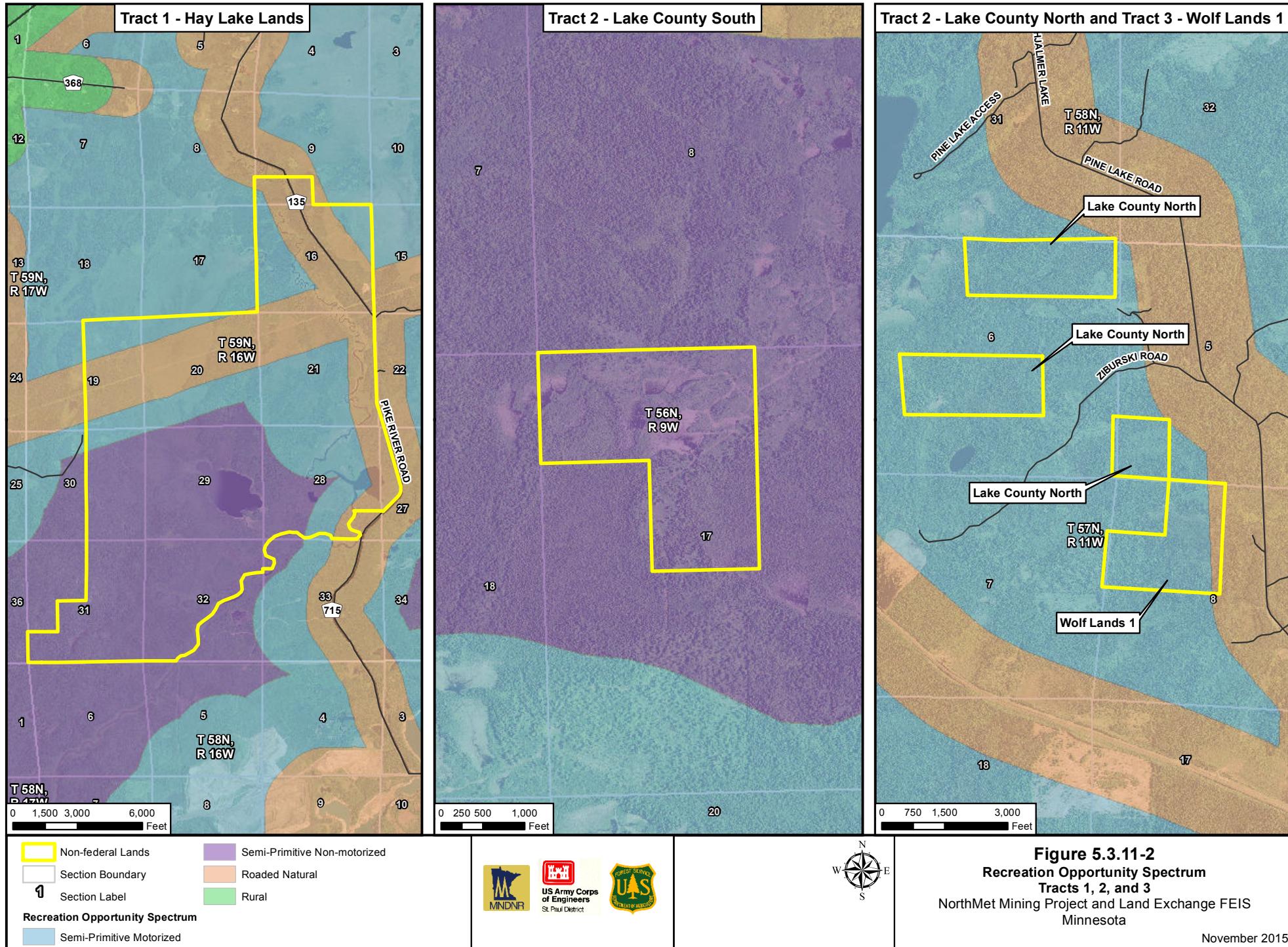


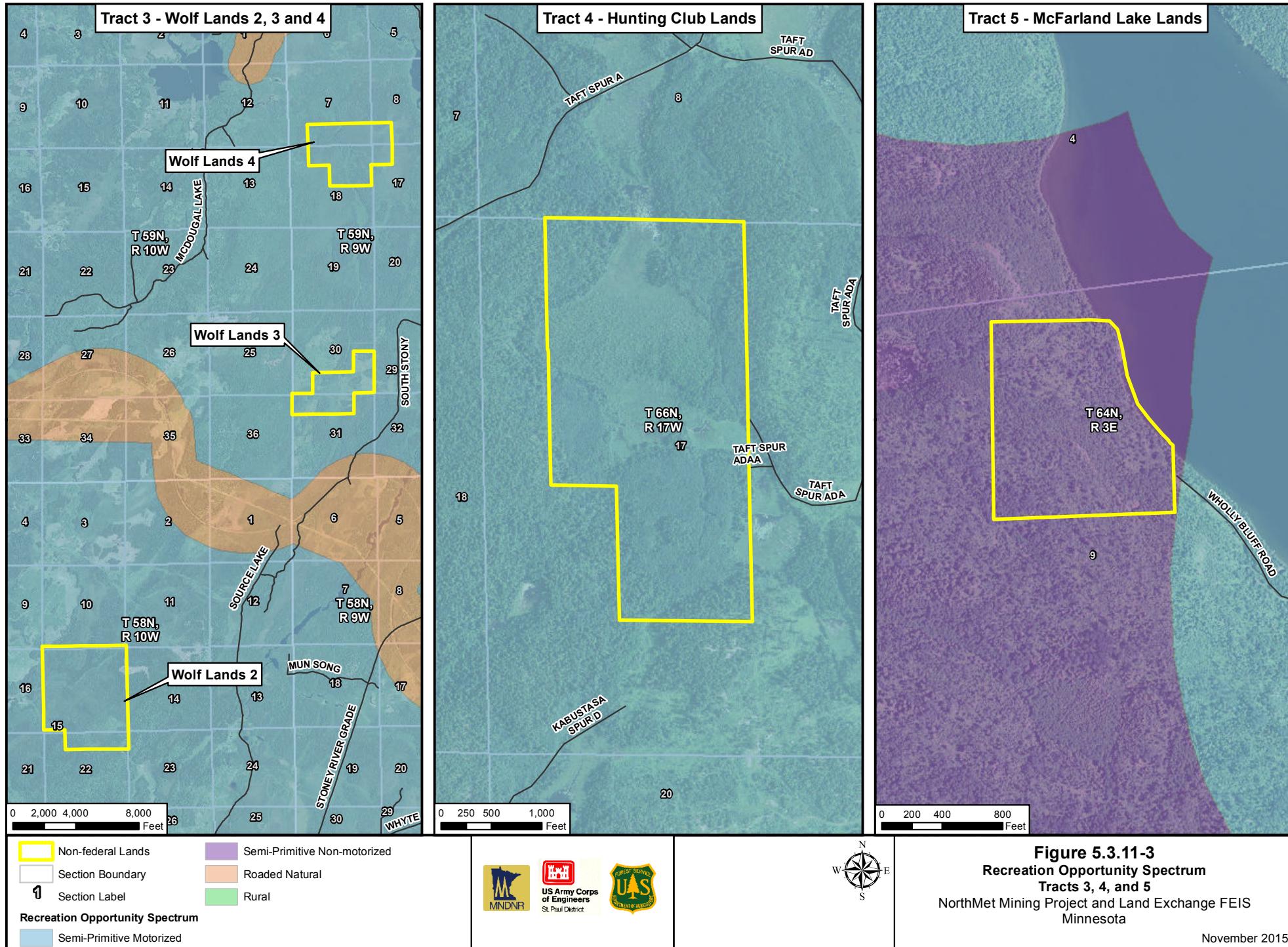
Figure 5.3.11-1
Recreation Opportunity Spectrum
Federal Lands
NorthMet Mining Project and Land Exchange FEIS
Minnesota

November 2015

-Page Intentionally Left Blank-



-Page Intentionally Left Blank-



-Page Intentionally Left Blank-

Table 5.3.11-3 Recreation Opportunity Spectrum Classifications of Federal and Non-Federal Lands (Land Exchange Proposed Action)

Parcel	Acres of ROS Class				Total
	Semi-Primitive Motorized	Semi-Primitive Non-Motorized	Roaded Natural	Total	
Lands Conveyed					
Federal lands	5,528.4	0.0	967.0	6,495.4	
Lands Acquired					
Tract 1 - Hay Lake	1,303.8	2,162.2	1,460.3	4,926.3	
Tract 2 - Lake County North	265.0	0.0	0.0	265.0	
Tract 2 - Lake County South	0.0	116.9	0.0	116.9	
Tract 3 - Wolf Lands 1	106.1	0.0	19.7	125.8	
Tract 3 - Wolf Lands 2	767.9	0.0	0.0	767.9	
Tract 3 - Wolf Lands 3	277.4	0.0	0.0	277.4	
Tract 3 - Wolf Lands 4	404.7	0.0	0.0	404.7	
Tract 4 - Hunting Club	160.2	0.0	0.0	160.2	
Tract 5 – McFarland Lake	0.0	30.8	0.0	30.8	
Subtotal: Non-federal Lands	3,285.1	2,319.9	1,480.0	7,075.0	
Net Change					
Net Increase/(Decrease)	(2,243.3)	2,309.9	513.0	579.6	

Source: USFS, Pers. Comm., November 29, 2011.

There is no public land access to and no practical opportunity for recreational activity on the federal lands, and the federal lands would remain inaccessible after completion of the Land Exchange Proposed Action. By comparison, the non-federal lands would be accessible to varying degrees, and therefore could host recreational activities, as defined by their respective ROS class. Tract 1 is the most accessible and therefore has the greatest potential for public recreational use. Tract 5 would likely be accessible from adjacent Superior National Forest land and/or the lake itself, while Tract 4 is also accessible via road and trail. Tracts 2 and 3 would be more difficult to access.

As Table 5.3.11-3 shows, the Land Exchange Proposed Action would result in a net decrease to the federal estate of 2,243.3 acres of land designated Semi-Primitive Motorized, an increase to the federal estate of 2,309.9 acres of land designated Semi-Primitive Non-Motorized, and an increase to the federal estate of 513.0 acres of Roaded Natural land. Although there would be a decrease of Semi-Primitive Motorized land to the federal estate, the Land Exchange Proposed Action overall would affect less than one-quarter of one percent of the total area of the Superior National Forest (approximately 3 million acres), and the reduction to the federal estate of this ROS type would be exceeded by the increase to the federal estate in other ROS types.

Because the federal lands are not accessible to the public by land, the Land Exchange Proposed Action represents an addition to the amount of potential publicly accessible land in the Superior National Forest. As a result, the Land Exchange Proposed Action would increase opportunities for hunting, fishing, and other recreational activities.

5.3.11.2.2 Visual Resources

SIOs for the federal lands are shown on Figure 5.3.11-4, while the SIOs that would be applied to the non-federal lands are shown in Figures 5.3.11-5 and 5.3.11-6. These are summarized in Table 5.3.11-4. The Low SIO of the federal lands indicates that the area may be dominated by management activities. Effects on visual resources on the federal lands are similar to those at the Mine Site, as discussed in Section 5.2.11.2.1.

The non-federal lands are only somewhat visible from public roads, few of which are elevated enough to afford views of the tracts themselves. Still, transfer of the non-federal lands to Superior National Forest ownership would generally help to preserve the scenic quality of those parcels. The NorthMet Project area would not be visible from any of the Land Exchange Proposed Action parcels.

The Land Exchange Proposed Action would result in a net decrease to the federal estate of 1,170.8 acres of land with a Low SIO and an increase to the federal estate of 136.3 acres of land with a High SIO and 1,644.6 acres of land with a Moderate SIO (see Table 5.3.11-4). This change in the composition of the visual character of the Superior National Forest, which affects less than one-quarter of one percent of the total area of the forest, would have generally positive effects. The addition of land with Moderate and High SIO (in lieu of land with a Low SIO) could affect the types of forestry and management activities that could occur on those lands. The USFS would acquire land with a wider diversity of SIOs (i.e., the addition of land with Moderate and High SIOs) and the Land Exchange Proposed Action would result in a net increase to the federal estate.

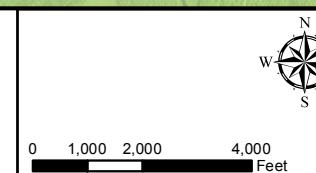
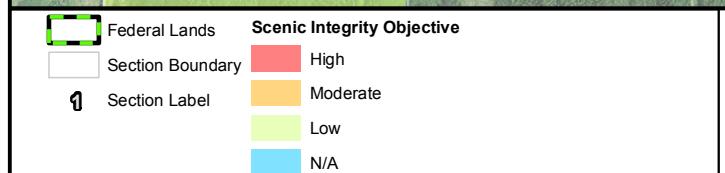
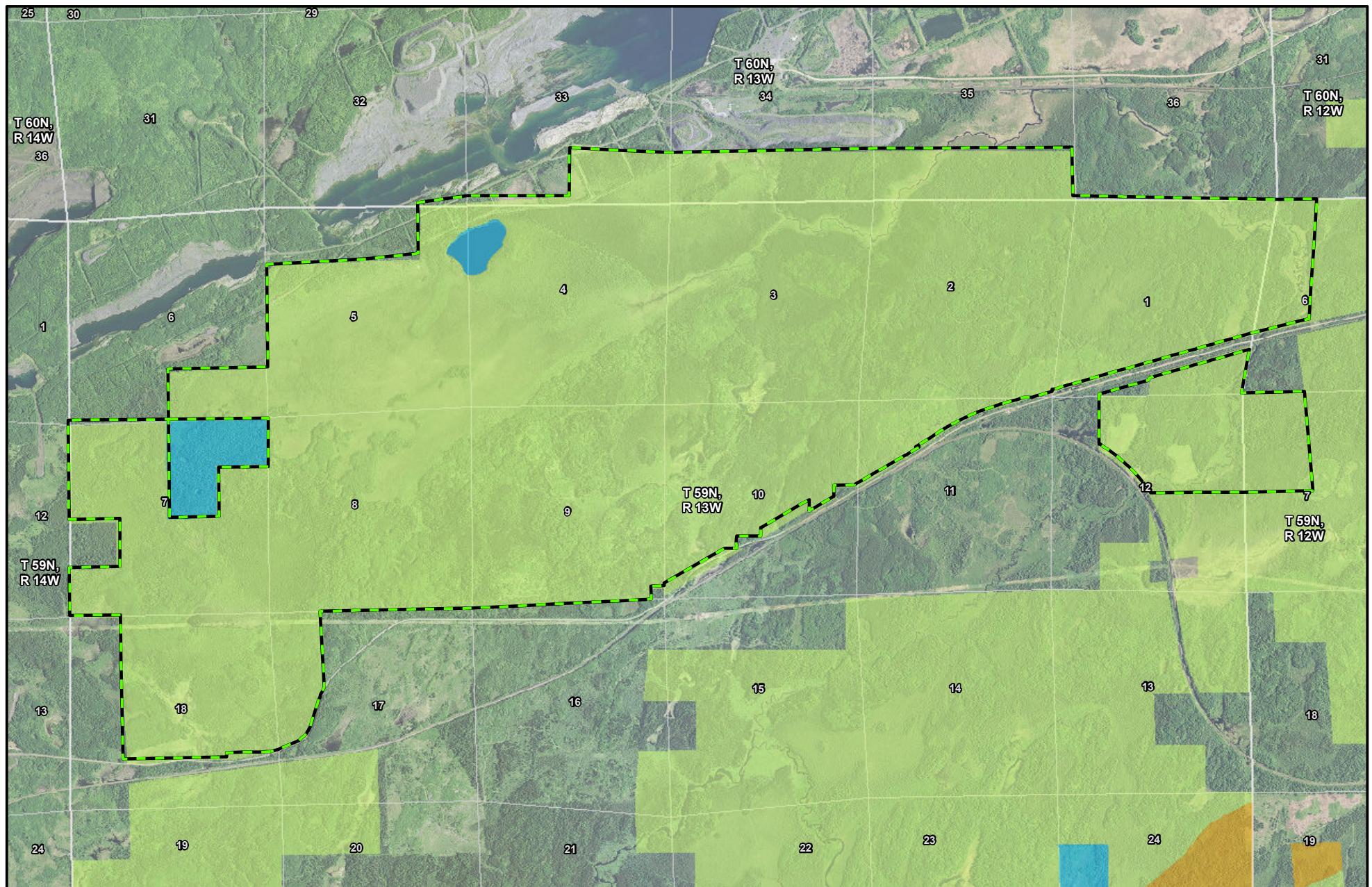
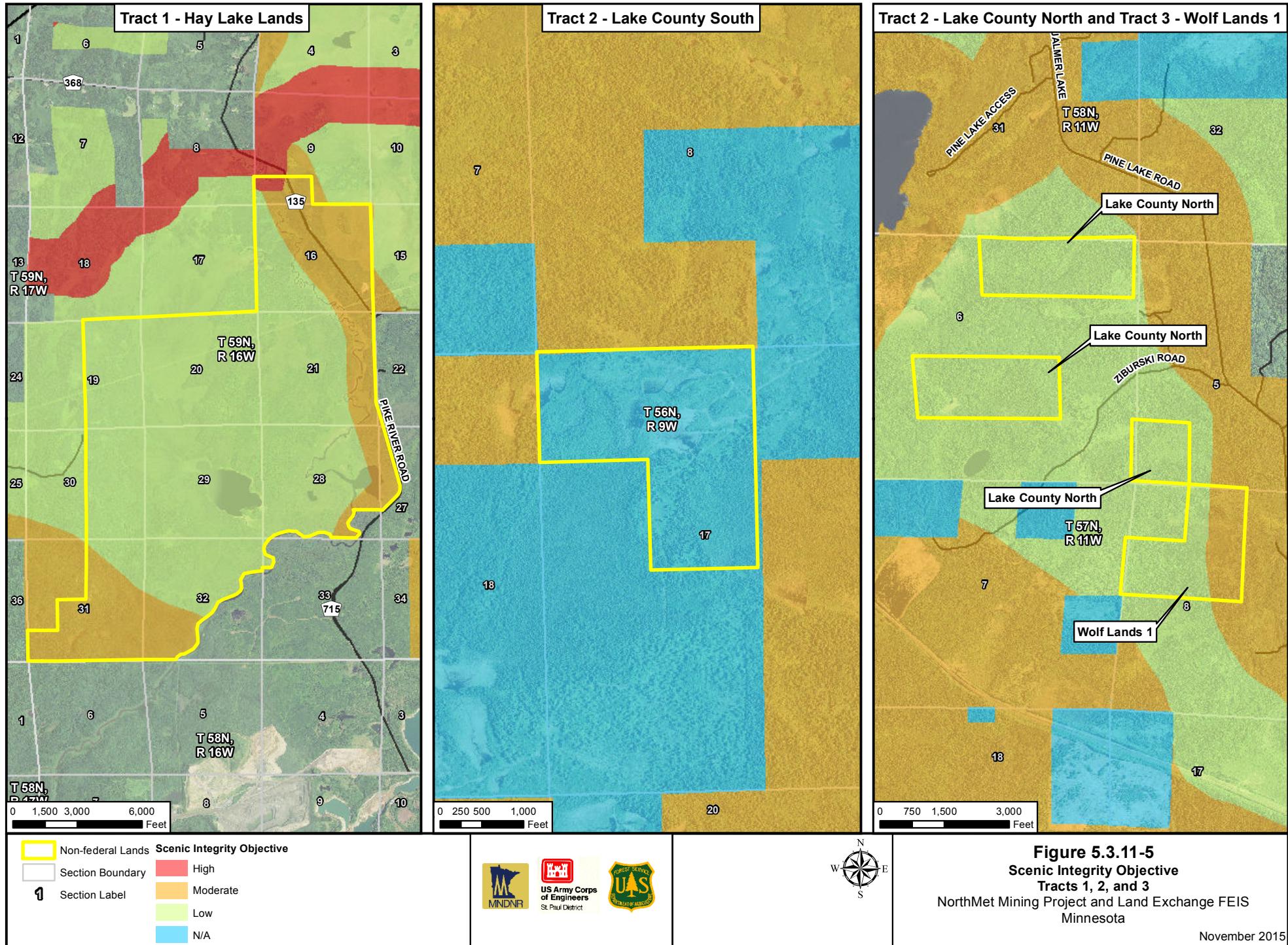


Figure 5.3.11-4
Scenic Integrity Objective
Federal Lands
NorthMet Mining Project and Land Exchange FEIS
Minnesota

November 2015

-Page Intentionally Left Blank-



-Page Intentionally Left Blank-

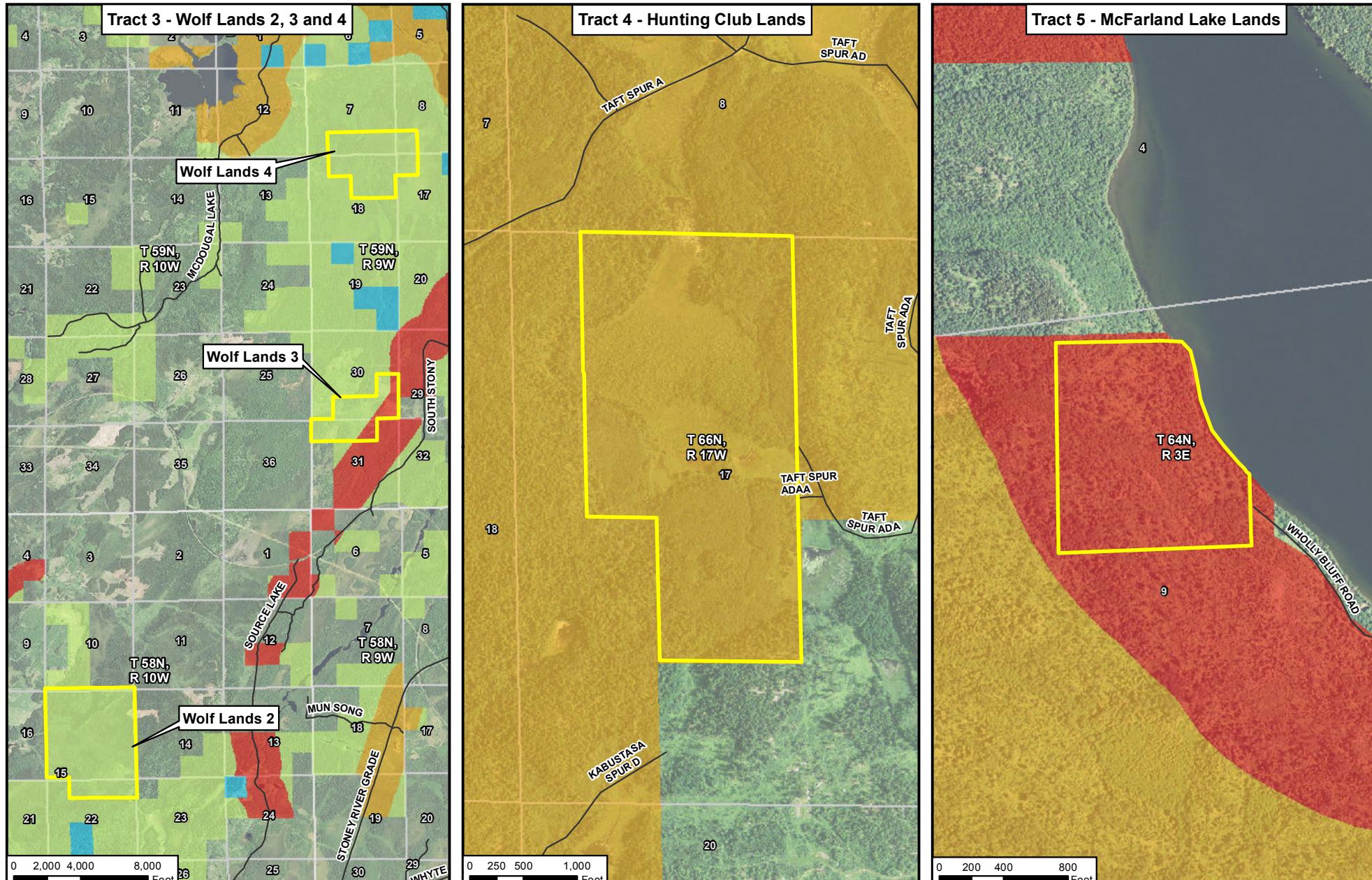


Figure 5.3.11-6
Scenic Integrity Objective
Tracts 3, 4, and 5
NorthMet Mining Project and Land Exchange FEIS
Minnesota

November 2015



-Page Intentionally Left Blank-

Table 5.3.11-4 Scenic Integrity Objectives of Federal and Non-Federal Lands (Proposed Action)

Parcel	Acres of Scenic Integrity Objective			
	High	Moderate	Low	Total
Lands Conveyed				
Federal lands	0.0	0.0	6,464.9 ⁽¹⁾	6,464.9 ⁽¹⁾
Lands Acquired				
Tract 1 - Hay Lake	20.4	1,315.4	3,590.5	4,926.3
Tract 2 - Lake County North	0.0	0.0	265.0	265.0
Tract 2 - Lake County South	0.0	116.9	0.0	116.9
Tract 3 - Wolf Lands 1	0.0	52.1	73.7	125.8
Tract 3 - Wolf Lands 2	0.0	0.0	767.9	767.9
Tract 3 - Wolf Lands 3	85.1	0.0	192.3	277.4
Tract 3 - Wolf Lands 4	0.0	0.0	404.7	404.7
Tract 4 - Hunting Club	0.0	160.2	0.0	160.2
Tract 5 – McFarland Lake	30.8	0.0	0.0	30.8
Subtotal: Non-federal Lands	136.3	1,644.6	5294.1	7,075.0
Net Change				
Net Increase/(Decrease)	136.3	1,644.6	(1,170.8)	610.1

Source: USFS, Pers. Comm., November 29, 2011.

Note:

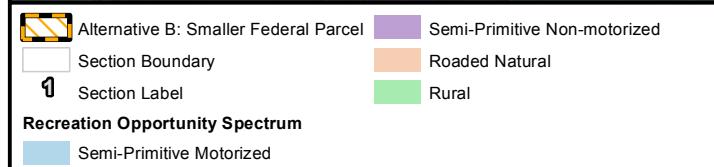
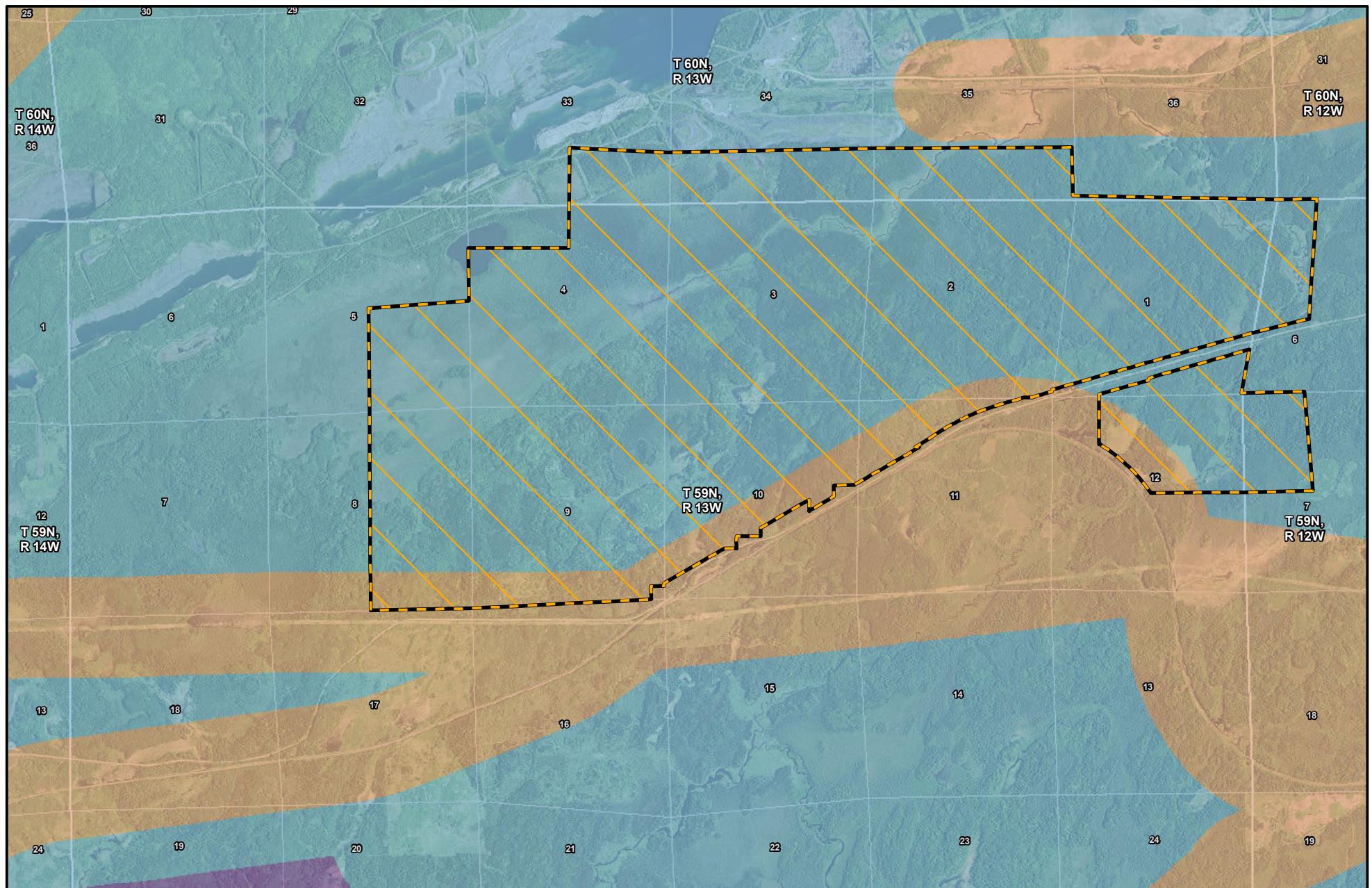
¹ Mud Lake (comprising 30.5 acres of the 6,495.4 acres in the federal lands) would not be managed by USFS, and therefore does not have a SIO.

5.3.11.3 Land Exchange Alternative B

5.3.11.3.1 Recreation

Under the Land Exchange Alternative B, 4,752.6 acres of federal lands would be exchanged for the 4,926.3-acre Tract 1. ROS classes for the federal lands portion of the Land Exchange Alternative B are shown on Figure 5.3.11-7 (Tract 1 classes would remain unchanged from the Land Exchange Proposed Action). Table 5.3.11-5 summarizes the ROS classes of these lands.

-Page Intentionally Left Blank-



0 1,000 2,000 4,000
Feet



Figure 5.3.11-7
Recreation Opportunity Spectrum
Alternative B: Smaller Federal Parcel
NorthMet Mining Project and Land Exchange FEIS
Minnesota

November 2015

-Page Intentionally Left Blank-

Table 5.3.11-5 Recreation Opportunity Spectrum Class of Federal and Non-federal Lands (Land Exchange Alternative B)

Parcel	Acres of ROS Class			
	Semi-Primitive Motorized	Semi-Primitive Non-Motorized	Roaded Natural	Total
<u>Lands Conveyed</u>				
Alternative B	4,276.5	0.0	476.1	4,752.6
<u>Lands Acquired</u>				
Tract 1 - Hay Lake	1,303.8	2,162.2	1,460.3	4,926.3
<u>Net Change</u>				
Net Increase (Decrease)	(2,972.7)	2,162.2	984.2	173.7

Source: USFS, Pers. Comm., November 29, 2011.

Similar to the Land Exchange Proposed Action, there is no public land access to and no opportunity for recreational activity on the federal lands, and the smaller federal parcel would remain inaccessible after completion of the Land Exchange Alternative B. By comparison, the non-federal lands (Tract 1) would be accessible (to varying degrees), and therefore would be capable of hosting recreational activities, as defined by their respective ROS classes. Tract 1 is accessible and therefore would result in the greatest potential for public recreational use.

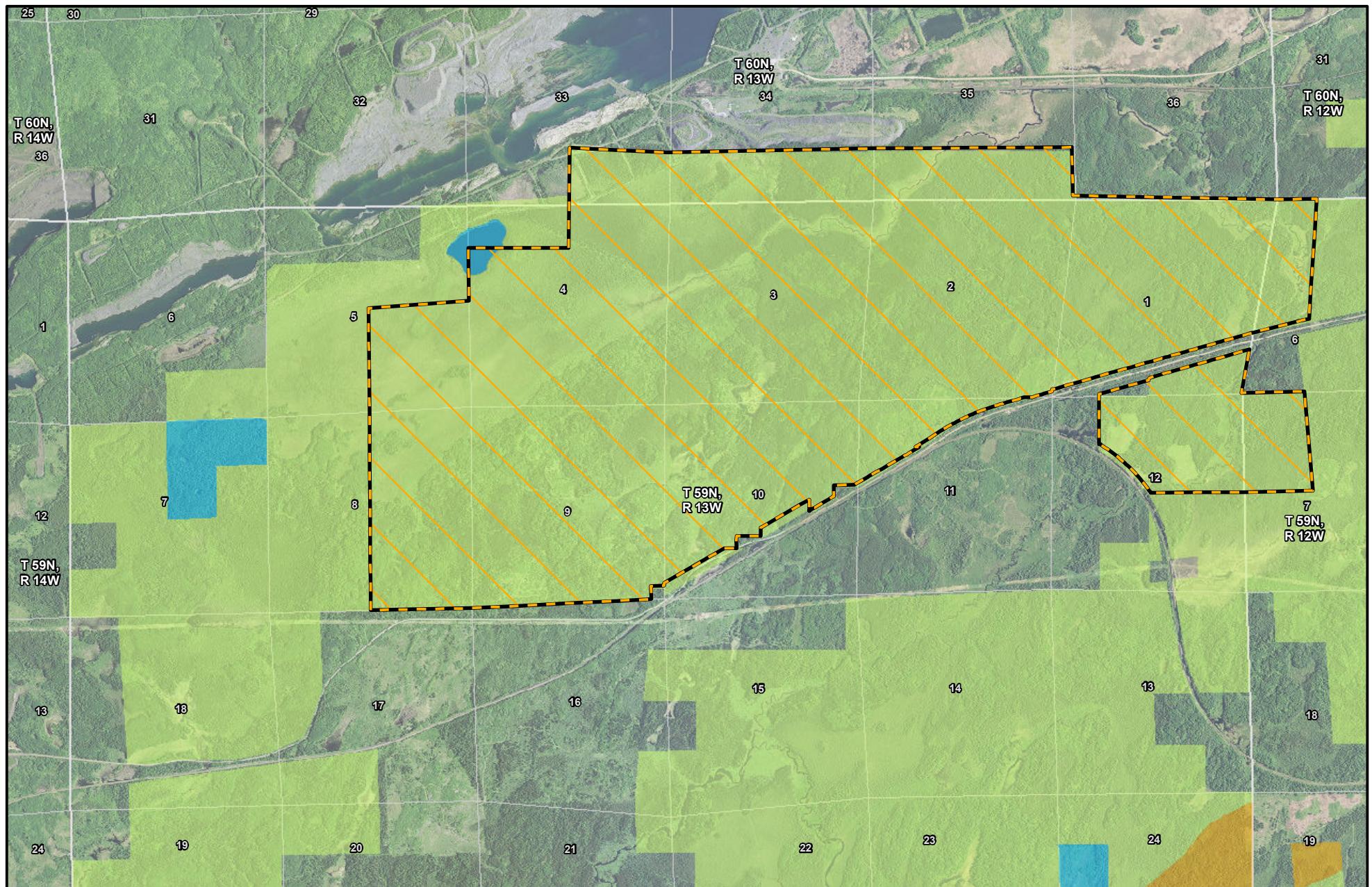
As Table 5.3.11-5 shows, the Land Exchange Alternative B would result in a net decrease to the federal estate of 2,972.7 acres of land designated as Semi-Primitive Motorized, and an increase to the federal estate of 2,162.2 acres of Semi-Primitive Non-Motorized land and 984.2 acres of Roaded Natural land. Although there would be a decrease of Semi-Primitive Motorized land, the Land Exchange Alternative B overall would affect less than one-quarter of one percent of the total area of the Superior National Forest, and the reduction to the federal estate of this ROS class would be exceeded by the increase to the federal estate in other ROS classes.

As with the Land Exchange Proposed Action, because the federal lands are not accessible to the public, the Land Exchange Alternative B represents an addition to the amount of potential publicly accessible land in the Superior National Forest. As a result, the Land Exchange Alternative B would increase opportunities for hunting, fishing, and other recreational activities. Overall, the effects of the Land Exchange Alternative B on recreation are similar to those of the Land Exchange Proposed Action, but smaller in magnitude, due to the reduced amount of land involved.

5.3.11.3.2 Visual Resources

SIO classifications for the smaller federal parcel are shown on Figure 5.3.11-8 (Tract 1 classifications would remain unchanged from the Land Exchange Proposed Action) and are summarized in Table 5.3.11-6. As with the Land Exchange Proposed Action, the Land Exchange Alternative B has a Low SIO, indicating the lands may be dominated by management activities; however, Tract 1 would only be somewhat visible from public roads and would generally help to preserve the scenic quality of the parcel. The NorthMet Project area would not be visible from Tract 1.

-Page Intentionally Left Blank-



Alternative B: Smaller Federal Parcel **Scenic Integrity Objective**

Section Boundary

1 Section Label

High

Moderate

Low

N/A



0 1,000 2,000 4,000
Feet



Figure 5.3.11-8
Scenic Integrity Objective
Alternative B: Smaller Federal Parcel
NorthMet Mining Project and Land Exchange FEIS
Minnesota

November 2015

-Page Intentionally Left Blank-

The Land Exchange Alternative B would result in a net decrease to the federal estate of 1,153.2 acres of land with a Low SIO, in exchange for an increase to the federal estate of 20.4 acres of land with a High SIO and 1,153.2 acres of land with a Moderate SIO. This change in the composition of the visual character of the Superior National Forest, which affects less than one-tenth of one percent of the total area of the Superior National Forest, would have generally positive effects. The addition of land with Moderate and High SIOs (in lieu of land with a Low SIO) could affect the types of forestry and management activities that can occur on those lands. The USFS would acquire land with a wider diversity of SIOs and the Land Exchange Alternative B would result in a net increase to the federal estate, although less than in the Land Exchange Proposed Action.

Table 5.3.11-6 Scenic Integrity Objectives of Federal and Non-federal Lands (Land Exchange Alternative B)

Parcel	Acres of Scenic Integrity Objective Classification			
	High	Moderate	Low	Total
Lands Conveyed				
Alternative B	0	0	4,743.7 ⁽¹⁾	4,743.7 ⁽¹⁾
Lands Acquired				
Tract 1 - Hay Lake	20.4	1,315.4	3,590.5	4,926.3
Net Change				
Net Increase (Decrease)	20.4	1,315.4	(1,153.2)	182.6

Source: USFS, Pers. Comm., November 29, 2011.

Note:

¹ Mud Lake (comprising 8.9 acres of the 4,752.6 acres in the smaller federal parcel), would not be managed by USFS, and therefore does not have a SIO.

5.3.11.4 Land Exchange No Action Alternative

5.3.11.4.1 Recreation

Under the Land Exchange No Action Alternative, the federal and non-federal lands would remain generally inaccessible to the public for recreation or other uses.

5.3.11.4.2 Visual Resources

Under the Land Exchange No Action Alternative, the visual appearance of the federal and non-federal lands would remain unchanged.

-Page Intentionally Left Blank-

5.3.12 *Wilderness and Other Special Designation Areas*

This section describes the potential environmental consequences of the Land Exchange Proposed Action on wilderness and other special designation area resources that are on or near the federal and non-federal lands.

The Land Exchange Proposed Action would not result in a net increase or decrease in any wilderness areas. However, the Land Exchange Proposed Action would result in a net increase of 306.9 acres of cRNAs to the federal estate through exchange of Tract 1. Land Exchange Alternative B would still include exchange of Tract 1; therefore, it would result in the same net changes to cRNA acreage as the Land Exchange Proposed Action.

The Land Exchange No Action Alternative would not affect wilderness or special-designation areas as the Land Exchange would not occur.

5.3.12.1 Methodology and Evaluation Criteria

An evaluation was conducted to determine the potential effect that the Land Exchange Proposed Action would have on the wilderness character of the area. Potential effects on noise, water resources, and recreation and visual resources were evaluated. The analysis of the wilderness character affected by the Land Exchange Proposed Action was guided by evaluation criteria that were developed by the USFS and other Co-lead Agencies.

Estimated ambient noise levels at each of the sensitive receptor sites adjacent to the federal lands were compared with modeled noise levels to determine effects. An appropriate noise propagation model was used to generate noise contours from the Mine Site and Plant Site. To determine effects on water resources, in addition to available information from field efforts already performed by PolyMet for the NorthMet Project Proposed Action, analysis of air photos and available GIS layers for federal and non-federal lands included data layers and other collected data such as NWI maps, soil maps/ecological land type maps, and FEMA floodplain maps. Scenic quality and integrity of lands being acquired and conveyed was determined based on desktop study and limited field observations where necessary. The Forest Plan uses a nationally recognized classification system, the ROS, to describe different recreation settings, opportunities, and experiences. Reviewing existing information and consultation with area land managers provided the information needed to understand the existing and potential recreation opportunities.

5.3.12.2 Land Exchange Proposed Action

The Land Exchange Proposed Action would result in a net increase of cRNAs to the federal estate. As indicated in Section 5.3.1, the USFS has determined that Tract 1 would have the following management area designations: General Forest and cRNA. Therefore, the Land Exchange Proposed Action would include the Pike Mountain and Loka Lake cRNAs (southwest corner and northeast corner of the tract, respectively). The addition of Tract 1 into the federally managed areas would extend the Pike Mountain cRNA by 135.7 acres of primarily hardwoods plant community, and would extend the Loka Lake cRNA by 171.2 acres of lowland black spruce and tamarack swamp. The remaining 4,619.3 acres would be allocated to General Forest.

Tracts 2, 3, 4, and 5 would not result in a net change to wilderness or other special designation areas.

5.3.12.3 Land Exchange Alternative B

The Land Exchange Alternative B would result in the same net increase of cRNAs to the federal estate as the Land Exchange Proposed Action. The Land Exchange Alternative B would not result in a net change to any wilderness area.

5.3.12.4 Land Exchange No Action Alternative

Under the Land Exchange No Action Alternative, the Superior National Forest would have an ongoing responsibility for managing the wilderness and other special designations on or near the federal lands in accordance with the Forest Plan. The Land Exchange No Action Alternative would not change the USFS's responsibility for managing these resources and would result in no further effects on existing wilderness areas or other special designated areas.

5.3.13 Hazardous Materials

The Land Exchange Proposed Action and the Land Exchange Alternative B would not include operations or activities that involve the use of hazardous materials on federal or non-federal lands beyond those activities specific to the NorthMet Project Proposed Action described in Section 5.2.13. AOCs associated with legacy contamination by hazardous materials from former activities and operations on these lands are discussed in Section 5.3.1.

-Page Intentionally Left Blank-

5.3.14 Geotechnical Stability

Geotechnical stability considerations for the proposed stockpiles that would be located on federal land subject to the Land Exchange Proposed Action or Land Exchange Alternative B within the NorthMet Project area are discussed in Section 5.2.14. There are no other existing or proposed large-scale waste material storage facilities on land subject to the Land Exchange Proposed Action or Land Exchange Alternative B.

-Page Intentionally Left Blank-